

TM 5-3820-233-35/2

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

**DIRECT SUPPORT, GENERAL SUPPORT,
AND DEPOT MAINTENANCE MANUAL**

**CRUSHER, SCREENING UNIT, DIESEL
ENGINE DRIVEN, SEMITRAILER
MOUNTED, 35 TON PER HOUR CAPACITY
(IOWA MANUFACTURING COMPANY
MODEL 2A-2B) FSN 3820-938-7942,
COMPONENT OF CRUSHING AND
SCREENING PLANT, DIESEL ENGINE
DRIVEN FSN 3820-878-4285**

HEADQUARTERS, DEPARTMENT OF THE ARMY

JUNE 1968

SAFETY PRECAUTIONS

BEFORE OPERATION

Make sure handrails and walkways are free of grease and oil. Do not leave tools, spare parts or other obstructions on the walkways.

Before starting the plant, be sure personnel are clear of the moving parts.

Before starting the power unit, be sure all clutches are disengaged.

Do not smoke and make certain there are no open flames in the immediate area when filling the fuel tank. Keep the container in contact with the tank being filled, or provide a ground to prevent a spark from igniting the fuel vapors.

DURING OPERATION

Do not wear loosely hanging clothing or neck ties on the job. Wear goggles or safety glasses, gloves, and hard hats during crushing operations.

Be sure all guards and covers are installed in their proper locations.

Do not operate the engine in an enclosed area unless the exhaust fumes are piped to the outside. Inhalation of exhaust fumes may result in serious illness or death.

Keep the equipment firmly blocked while operating.

Always keep hands clear of moving parts. Never attempt to wipe oil, refuel, or make adjustments while the plant is in operation.

Report or correct any conditions that may result in injury to personnel if operation is to be continued.

AFTER OPERATION

Make adjustments in a proper manner. Be sure all guards and cover are properly installed after adjustment or maintenance operation.

Do not perform welding operation until the welder ground is placed as near to the area of welding as possible to prevent possible arcing through bearings or other vital parts.

Do not use a lifting device with a capacity of less than 8,000 pounds when lifting any major assemblies. Use an adequate lifting device when lifting heavy components. Do not allow suspended major assemblies or components to swing. Failure to observe this warning may result in serious injury or death to personnel.

Never leave a heavy assembly or component in an unstable position that could result in the assembly or component falling on personnel.

TECHNICAL MANUAL
No. 5-3820-233-35/2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 25 June 1968

Direct Support, General Support and Depot Maintenance Manual

**CRUSHER, SCREENING UNIT, DIESEL ENGINE DRIVEN
SEMTRAILER MOUNTED, 35 TON PER HOUR CAPACITY
(IOWA MANUFACTURING COMPANY MODEL 2A-2B)
FSN 3820-938-7942, COMPONENT OF CRUSHING AND
SCREENING PLANT, DIESEL ENGINE DRIVEN
FSN 3820-878-4285**

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the use of direct and general support and depot maintenance personnel maintaining the Iowa Manufacturing Model 2A-2B Portable Secondary Crushing and Screening Plant. They provide information on the maintenance of the equipment which is beyond the scope of the tools, equipment, personnel, or supplies normally available to using organizations.

b. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to the Commanding

General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Missouri 63120.

c. Report all equipment improvement recommendations as prescribed by TM 38-750.

2. Record and Report Forms

a. DA Form 2258 (Depresrvation Guide of Engineer Equipment).

b. For other record and report forms applicable to direct and general support and depot maintenance, refer to TM 38-750.

Note. Applicable forms, excluding standard Form 46 (United States Government Motor Vehicles Operator's Identification Card) which is carried by the operator, shall be kept in a canvas bag mounted on the equipment.

Section II. DESCRIPTION AND DATA

3. Description

A general description of the Portable Secondary Crushing and Screening Plant, the location and description of the identification and instruction plates, and information on the differences in models are contained in the Operator and Organizational Maintenance Manual. The repair and maintenance instructions are described in appropriate sections of this manual.

4. Tabulated Data

a. *General.* This paragraph contains all the overhaul data pertinent to direct and general support and depot maintenance personnel. A wiring diagram (fig. 1) is also included.

b. Capacity of Plant.

Rating _____ 35 tons per hour of
1 1/2" material @
80% crushed (Based
on material weight
of 100 lbs. per cubic
foot)

c. Engine

Manufacturer	General Motors
Model	4031C
Series	71
Number of cylinders	4
Displacement	284 cubic inches
Bore	4 1/4 inches
Stroke	5 inches
Compression ratio	17 to 1
Firing order	1-3-4-2
Number of main bearings	5

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Crankshaft Rotation (viewed from fan end).	Clockwise
Rated horsepower 1800 RPM.	113 HP
Low idle speed	550 PRM
High idle speed	1890 RPM
Governed full load speed.	1800 RPM
<i>d. Overhead Conveyor</i>	
Type	Belt
Belt dimensions	Width—24 inches (4 ply) Length—43 feet
Length	20 feet
Bearings (head and tail pulleys).	Flange type—roller brg
Troughing roll assemblies	Three roll type
Return roll assemblies	Single roll type
Head pulley	10 inches x 26 inches, lagged
Wing pulley	8 inches x 26 inches
<i>e. Side Delivery Conveyors (Rock and Sand)</i>	
Type	Belt folding
Belt dimensions	Width—24 inches Length—37 ft. 6 in.
Bearings (head and tail shaft).	Flange type—ball bearing
Troughing roll assemblies	Three roll type
Head pulley	8 inches dia. x 26 inches long - solid type
Tail pulley	8 inches dia. x 26 inches long - solid type—lagged
Clutch	Twin disc model CL208
<i>f. Undercrusher Conveyor</i>	
Type	Belt
Belt dimensions	Width—24 inches (4 ply) Length—13 1/2 feet
Length	6 feet
Bearings (head and tail shaft).	Ball bearing—pillow block

j. Standard Engine Nut and Bolt Torque Data.

Size nut or bolt	Torque ft-lb	Size nut or bolt	Torque ft-lb	Size nut or bolt	Torque ft-lb
1/4-20	7-9	7/16-20	57-61	3/4-10	240-250
1/4-28	8-10	1/2-13	71-75	3/4-16	290-300
5/16-18	13-17	1/2-20	83-93	7/8-9	410-420
5/16-24	15-19	9/16-12	90-100	7/8-14	475-485
3/8-16	30-35	9/16-18	107-117	1-8	580-590
3/8-24	35-39	5/8-11	137-147	1-14	685-695
7/16-14	46-50	5/8-18	168-178		

k. Specific Engine Nut and Bolt Torque Data

Cylinder Block:	
Hand hole cover	3/8-16

10-15 ft-lb

Main bearing bolt (boring)	5/8-11	165-175 ft-lb
Main bearing bolt (assembly).	5/8-11	180-190 ft-lb
Main bearing nut (boring)	5/18-18	140-155 ft-lb
Main bearing nut (assembly).	5/8-18	155-185 ft-lb
Cylinder head stud		75 ft-lb
Main bearing stud		35-75 ft-lb
Cylinder Head:		
Cam follower guide bolt	1/4-20	12-15 ft-lb
Injector control shaft bracket bolt.	1/4-20	10-12 ft-lb
Injector clamp bolt	3/8-16	20-25 ft-lb
Injector clamp nut	3/8-24	20-25 ft-lb
Exhaust manifold outlet flange nuts (brass).	3/8-24	20-25 ft-lb
Water manifold nut	3/8-24	25-30 ft-lb
Fuel pipe nut	3/8-24	12-15 ft-lb
Lifter bracket bolt	7/16-24	55-60 ft-lb
Exhaust manifold nuts	7/16-20	30-35 ft-lb
Rocker shaft bolt	1/2-13	90-100 ft-lb
Cylinder head bolts	5/8-11	175-185 ft-lb
Cylinder head nuts	5/8-18	175-185 ft-lb
Crankshaft:		
Crankshaft front cover	3/8-16	25-30 ft-lb
Crankshaft front cover	3/8-24	25-30 ft-lb
Connecting rod nut (lubrite)	7/16-20	60-70 ft-lb
Connecting rod nut (castellated).	7/16-20	65-75 ft-lb
Crankshaft front cover	1/2-13	80-90 ft-lb
Main bearing bolt	5/8-11	180-190 ft-lb
Main bearing nut	5/8-18	155-185 ft-lb
Crankshaft end bolt	1-14	290-310 ft-lb
Flywheel and Flywheel Housing:		
Flywheel bolts	9/16-18	150-160 ft-lb
Oil pan bolts	5/16-18	10-12 ft-lb
Flywheel housing bolts	3/8-16	25-30 ft-lb
Idler gear hub and spacer	3/8-16	40-45 ft-lb
Idler gear hub and spacer	3/8-16	25-40 ft-lb
Flywheel housing bolts	3/8-24	25-30 ft-lb
Lifter bracket bolts	7/16-14	55-60 ft-lb
Flywheel housing bolts	1/2-13	90-100 ft-lb
Piston and Piston Rings:		
Air box cover bolt	3/8-16	10-15 ft-lb
Connecting rod nut (lubrite)	7/16-20	60-70 ft-lb
Connecting rod nut (castellated).	7/16-20	65-75 ft-lb
Camshaft and Balance Shaft:		
Blower drive coupling to gear hub bolt.	5/16-24	20-25 ft-lb
Idler gear bearing retainer bolt.	5/16-24	24-29 ft-lb
Flywheel housing bolts	3/8-16	25-30 ft-lb
Cam and balancer shaft end bearing bolt.	3/8-16	35-40 ft-lb
Flywheel housing to idler gear hub and spacer locking bolt only).	3/8-16	40-45 ft-lb

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Flywheel housing to idler gear hub and spacer (wired bolt only)	3/8-16	25-30	ft-lb
Balance weight cover bolt	3/8-16 & 24	25-30	ft-lb
Camshaft intermediate bearing lock screw	8/8-24	15-20	ft-lb
Blower drive gear hub bearing support bolts & nuts.	3/8-24	25-30	ft-lb
Balance weight to timing gear bolt.	3/8-24	25-30	ft-lb
Generator drive bearing retaining bolt.	7/16-14	30-35	ft-lb
Generator drive oil seal retaining bolt.	7/16-14	30-35	ft-lb
Tachometer drive cover bolt	7/16-14	30-35	ft-lb
Generator drive bearing retaining bolt.	1/2-13	30-35	ft-lb
Generator drive oil seal retaining bolt.	1/2-13	30-35	ft-lb
Tachometer drive cover bolt	1/2-13	30-35	ft-lb
Rocker shaft bolt	1/2-13	90-100	ft-lb
Idler gear and dummy hub bolt.	1/2-13	80-90	ft-lb
Blower rotor gear retaining nut.	1/2-20	55-65	ft-lb
Crankshaft end bolt	1-14	290-310	ft-lb
Camshaft and balancer shaft nut.	1 1/8-18	300-325	ft-lb
Blower drive gear hub nut	1 1/2-16	50-60	ft-lb
Fuel System:			
Injector clamp stud	3/8-16	10-25	ft-lb
Injector clamp bolt	3/8-16	20-25	ft-lb
Injector clamp nut	3/8-24	20-25	ft-lb
Fuel pipe nut	3/8-24	12-15	ft-lb
Rocker arm bracket bolt	1/2-13	90-100	ft-lb
Injector filter cap	5/8-24	65-75	ft-lb
Injector nut (needle valve)	15/16-24	75-85	ft-lb
Air Intake System:			
Blower lower front bearing retaining bolt (allen head).	5/16-24	18	ft-lb
Blower drive plate-to-drive hub bolt.	5/16-24	25-30	ft-lb
Blower drive hub-to-blower rotor gear bolt.	5/16-24	25-30	ft-lb
Air inlet housing-to-blower housing bolt.	3/8-16	16-20	ft-lb
Blower housing-to-cylinder block bolt.	7/16-14	55-60	ft-lb
Blower rotor timing gear bolt.	7/16-20	55-65	ft-lb
Blower rotor timing gear bolt	1/2-20	55-65	ft-lb
Lubrication System:			
Oil pan bolts	5/16-18	10-12	ft-lb
Oil pump-to-bearing cap bolt	3/8-24	25-30	ft-lb
Oil pump drive idler gear nut (marsden)	1/2-20	60-70	ft-lb
Oil pan drain plug	18 m.m.	35-40	ft-lb

Power Take-Off:

Clutch drive shaft nut	1 8/4-10	225-230 ft-lb
Clutch driving ring bolt	1/2-13	71-75 ft-lb
Clutch housing bolt	7/16-14 x 1 1/4	46-50 ft-lb
Screen Vibrator Unit		
Backplate capscrews		25 ft-lb

1. *Repair and Replacement Standards.* Tables 1 and 2 list manufacturer's sizes, tolerances, desired clearances, and maximum allowable wear and clearances.

Table 1. Engine Repair and Replacement Standards

Components	Manufacturer's dimensions and tolerances in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
Cylinder Head:					
Flatness (transverse)	-----	-----	-----	-----	0.0040
Flatness (longitudinally)	-----	-----	-----	-----	0.0080
Distance between top deck and fire deck	3.5560	3.5680	-----	-----	3.5360
Water Nozzles	0.03125	flush	-----	-----	-----
recessed					
Cam Follower Boxes	-----	-----	1.0620	1.0630	1.0650
Exhaust Valve Seat Inserts:					
Seat width (30°)	0.0625	0.09375	-----	-----	0.09375
Valve seat runout	-----	0.0020	-----	-----	0.0020
Exhaust Valves:					
Stem diameter	0.3417	0.3425	-----	-----	0.3405
Valve head to cylinder head	0.0020	0.0280	-----	-----	-----
recessed		protrusion			
Valve Guides:					
Height above cylinder head	1.59375	1.59375	-----	-----	1.59375
Diameter (inside)	0.3445	0.3445	-----	-----	0.3465
Clearance—stem to guide	-----	-----	0.0020	0.0038	0.0060
Rocker Arms and Shafts:					
Rocker shaft diameter	0.8735	0.8740	-----	-----	-----
Rocker arm shaft bushing inside diameter	0.8750	0.8760	-----	0.0010	0.0025
Clearance—shaft to bushing	-----	-----	-----	0.0040	-----
Cam Followers:					
Diameter	1.0600	1.0610	-----	-----	-----
Clearance—follower to head	-----	-----	0.0010	0.0030	0.0060
Cam Follower Rollers and Pins:					
Clearance—pin to bushing	-----	-----	0.0013	0.0021	0.0100
Side clearance—roller in follower	-----	-----	0.0150	0.0230	0.0280
Crankshaft:					
Journal diameter—main bearing	8.499	8.500	-----	-----	-----
Journal diameter—connecting rod	2.749	2.750	-----	-----	-----
Journal out of round	-----	0.00025	-----	-----	0.0010
Journal taper	-----	0.0005	-----	-----	0.0015
Runout on journals:					
No. 2 and No. 5 journals	-----	0.002	-----	-----	-----
No. 3 journal	-----	0.004	-----	-----	-----
Thrust washer, thickness	0.1205	0.1220	-----	-----	-----
End thrust clearance (end play)	-----	-----	0.0040	0.0110	0.0180
Main Bearings:					
Bearing inside diameter (vertical axis)	3.5014	3.5034	-----	-----	0.0060
Clearance—bearing to journal	-----	-----	0.0014	0.0044	0.1530
Bearing thickness—90° from parting line	0.1548	0.1553	-----	-----	(min.)

Table 1. Engine Repair and Replacement Standards—Continued.

Components	Manufacturer's dimensions and tolerances in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
Connecting Rod Bearings:					
Inside diameter (vertical axis)	2.7514	2.7534	-----	-----	-----
Clearance—bearing to crankshaft journal	-----	-----	0.0014	0.0044	0.0060
Bearing thickness—90° from parting line	0.1548	0.1553	-----	-----	0.1530 (min.)
Cylinder Block:					
Main bearing bore—inside diameter (vertical axis)	3.812	3.8130	-----	-----	-----
Block bore:					
Diameter	4.6265	4.6275	-----	-----	-----
Out-of-round	-----	0.0010	-----	-----	0.0030
Taper	-----	0.0010	-----	-----	0.0020
Cylinder liner counterbore:					
Diameter	5.0460	5.0485	-----	-----	-----
Depth	0.4785	0.4795	-----	-----	-----
Cylinder liners:					
Outside diameter	4.6250	4.6260	-----	-----	-----
Inside diameter	4.2495	4.2511	-----	-----	-----
Clearance—liner to block bore	-----	-----	0.0005	0.0025	0.0030
Out-of-round—liner inside diameter	-----	0.0020	-----	-----	0.0030
Taper—liner inside diameter	-----	0.0010	-----	-----	0.0020
Depth of liner flange BELOW High block	0.0465	0.0500	-----	-----	0.0500
Height of liner ABOVE low block	0.0020	0.0060	-----	-----	0.0060
Variation in height between adjacent liners	-----	0.0020	-----	-----	0.0020
Pistons and Rings:					
Piston:					
Height (centerline of bushing top of piston)	3.5130	3.5180	-----	-----	-----
Diameter:					
At top	4.2190	4.2220	-----	-----	-----
At skirt (below compression ring grooves to bottom)	4.2438	4.2455	-----	-----	-----
Clearance—piston skirt to line	-----	-----	0.0040	0.0078	0.0120
Out-of-round	-----	0.0005	-----	-----	-----
Taper	-----	0.0005	-----	-----	-----
Compression rings:					
Gap	0.0180	0.0430	-----	-----	0.0600
Clearance—ring to groove:					
Top ring	0.0095	0.0130	-----	-----	0.0220
No. 2	0.0075	0.0110	-----	-----	0.0150
No. 3 and 4	0.0055	0.0090	-----	-----	0.0130
Oil control rings:					
Gap	0.0080	0.0230	-----	-----	0.0430
Clearance—ring to groove	0.0015	0.0055	-----	-----	0.0080
Piston Pins:					
Diameter	1.4996	1.5000	-----	-----	1.4980
Pin-to-piston bushing clearance	-----	-----	0.0025	0.0034	0.0100
Pin-to-rod bushing clearance	-----	-----	0.0015	0.0024	0.0100
Length	3.6050	3.6200	-----	-----	-----
--- clearance	-----	-----	0.0160	0.0640	0.0640
	1.5025	1.5030	-----	-----	1.5050
	1.5015	1.5020	-----	-----	1.5080
	-----	0.0060	0.0120	-----	-----

Table 1. Engine Repair and Replacement Standards—Continued.

Components	Manufacturer's dimensions and tolerances in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
Camshaft:					
Shaft diameter—at bearings					
Front and rear	1.4970	1.4975	-----	-----	-----
Center and intermediate	1.4980	1.4985	-----	-----	-----
Shaft diameter—at gear	1.1875	1.1880	-----	-----	-----
Length—thrust bearing end journal	2.8740	2.8760	-----	-----	-----
End thrust	0.0040	0.0120	-----	-----	0.0180
Thrust washer thickness	0.1200	0.1220	-----	-----	-----
Balance Shaft:					
Shaft diameter and bearing	1.4970	1.4975	-----	-----	-----
Shaft diameter at gear	1.1875	1.1880	-----	-----	-----
Length—thrust bearing	2.8740	2.8760	-----	-----	-----
End thrust	0.0040	0.0120	-----	-----	0.0180
Thrust washer thickness	0.1200	0.1220	-----	-----	-----
Camshaft and Balance Shaft Bearings					
Inside diameter:					
Front and rear	1.5000	1.5010	-----	-----	-----
Center and intermediate	1.5010	1.5030	-----	-----	-----
Clearance—bearings-to-shaft					
Front and rear (next to flange)	-----	-----	0.0025	0.0040	0.0060
Center and intermediate	-----	-----	0.0025	0.0050	0.0050
Outside diameter of bearings					
Front and rear	2.1880	2.1885	-----	-----	-----
Intermediate	2.1840	2.1860	-----	-----	-----
Diameter of block bore	2.1875	2.1885	-----	-----	-----
Clearance—bearings-to-block					
Front and rear	-----	-----	0.001	0.0005	-----
Intermediate	-----	-----	Press	Loose	-----
0.0015	0.0045				
Camshaft and Balance Shaft Gears					
Backlash	0.0030	0.0080	-----	-----	0.010
Gear inside diameter	1.1865	1.1875	-----	-----	-----
Clearance—gear-to-shaft	-----	-----	0.0015	0.0000	-----
Press					
Idler Gear:					
Backlash	0.0030	0.0080	-----	-----	0.010
Preload—Variation on pull 2 lbs.-11 oz.	1/2 lb.	6 3/4 lbs.	-----	-----	1/2-6 3/4 lbs.
Crankshaft Timing Gear:					
Backlash	0.0030	0.0080	-----	-----	0.010
Gear inside diameter	4.7490	4.7500	-----	-----	-----
Clearance—gear-to-crankshaft	-----	-----	0.001	0.001	-----
Press					
Loose					
Blower Drive Gear:					
Backlash	0.0030	0.0080	-----	-----	0.010
Gear-to-hub-fit	0.0005	0.0010	-----	-----	-----
Press	Loose	-----	-----	-----	-----
0.0005	0.0025	-----	-----	-----	-----
1.6260	1.6265	-----	-----	-----	-----
1.6240	1.6250	-----	0.0010	0.0025	0.0050
-----	-----	-----	0.0020	0.0070	-----
0.0050	0.0080	-----	-----	-----	0.0100
End thrust					

Table 1. Engine Repair and Replacement Standards—Continued.

Components	Manufacturer's dimensions and tolerances in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
Blower:					
Backlash—Timing gears	0.0005	0.0025	-----	-----	0.004
Oil seal (below end plate surface)	0.002	0.008	-----	-----	-----
Pin-dowel (projection beyond inside face of end plates)	0.380	-----	-----	-----	-----
Clearances:					
End to end plate—gear end	-----	-----	0.007	-----	-----
Rotor to end plate—front end	-----	-----	0.009	-----	-----
Rotor to housing—inlet side	-----	-----	0.015	-----	-----
Rotor to housing—outlet side	-----	-----	0.004	-----	-----
Trailing edge of upper rotor to leading edge of lower rotor	-----	-----	0.002	0.006	0.006
Leading edge of upper rotor to trailing edge of lower rotor	-----	-----	0.012	-----	-----

Table 2. Secondary Crushing and Screening Plant Repair Replacement Standards

Components	Manufacturer's dimensions and tolerances in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
Screen Vibrator Unit					
Clearance—inner rotation seal to inner fixed seal	-----	-----	0.010	-----	-----
Roll Crusher					
Clearance—spur gear to spur pinion	-----	-----	0.090	-----	-----
Backlash—spur gear and pinion	0.016	0.024	-----	-----	-----

m. *Schematic Wiring Diagram.* Figure 1 shows the schematic wiring diagram for this Portable Secondary Crushing and Screening Plant.

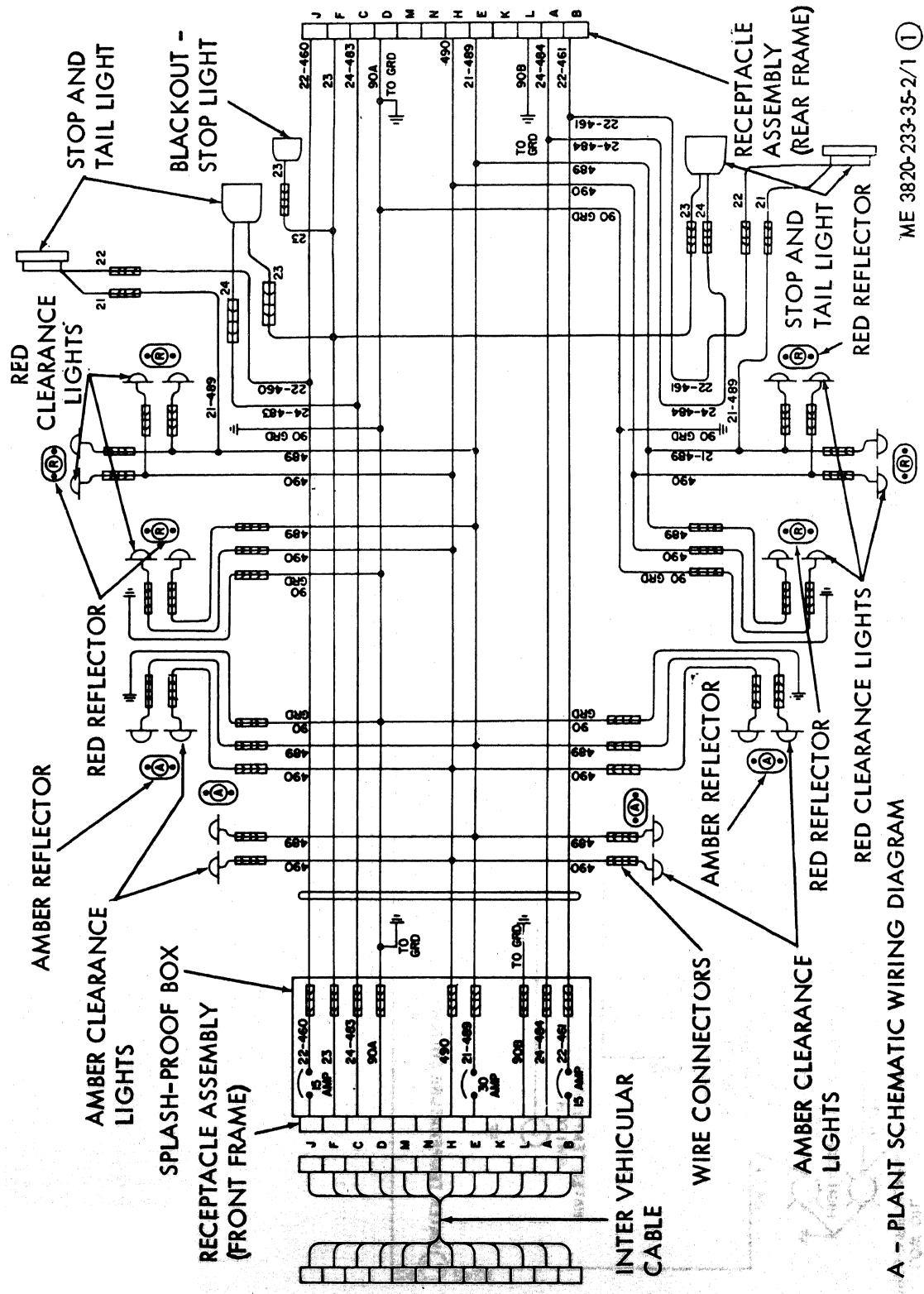
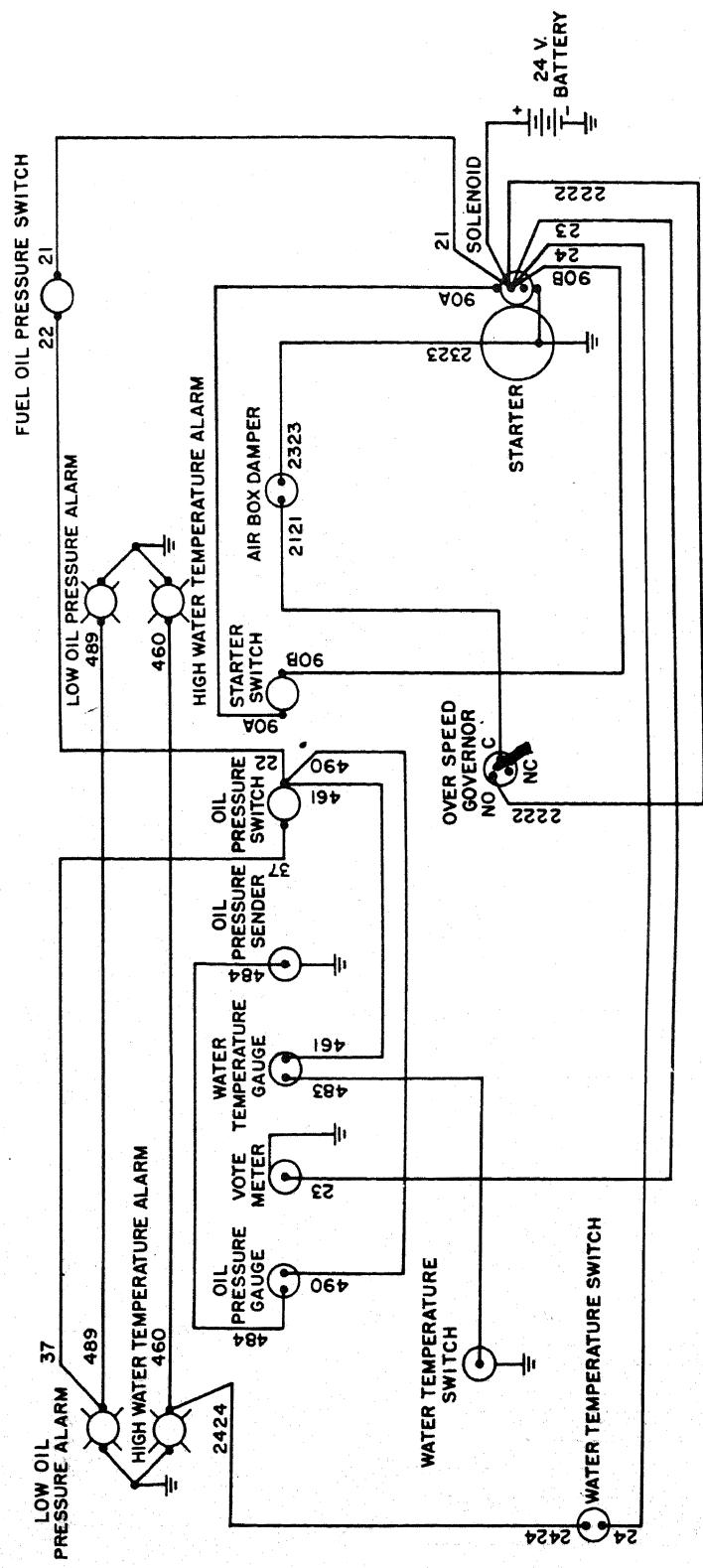
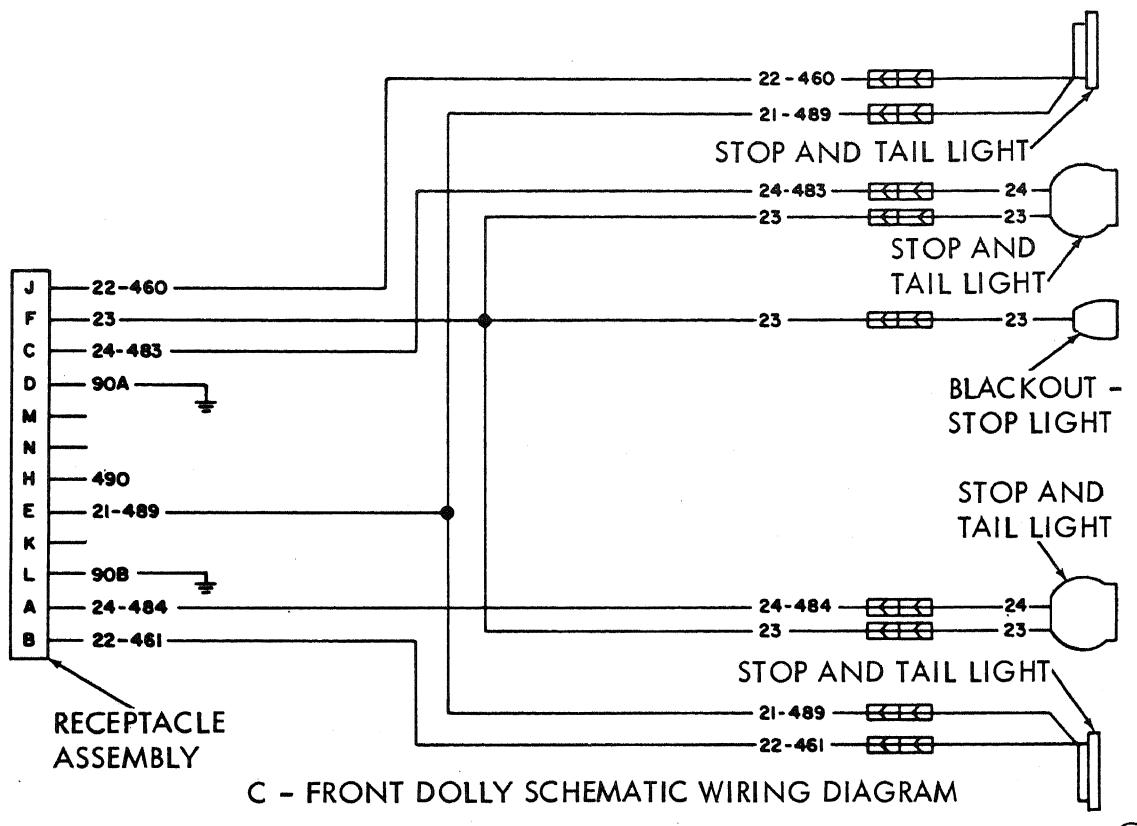


Figure 1 (1). Schematic wiring diagram.



B - POWER UNIT SCHEMATIC WIRING DIAGRAM.
ME 3820-233-35/2/1 ②

Figure 1 (2)—Continued.



ME 3820-233-35-2/1 (3)

Figure 1 (3)—Continued.

CHAPTER 2

GENERAL MAINTENANCE INSTRUCTIONS

Section I. SPECIAL TOOLS AND EQUIPMENT

5. Special Tools and Equipment

The special tools required to perform direct and general support and depot maintenance on the Portable Secondary Crushing and Screening Plant are listed in Table 3 and the applicable appendix of this manual. References

and illustrations indicating the use of these tools are listed in the table. No special equipment is required by direct and general support and depot maintenance personnel for performing maintenance on the Portable Secondary Crushing and Screening Plant.

Table 3. Special Tools

Item	FSN or part No.	Ref.	Use
Gear Puller Consists of:			
Puller bar (1)	(31245) 4400A55-01	Fig. 42-2 Fig. 42-4 Para 7	Spur and finger gear removal
Cross plate (2)	(31245) 4400A55-02		
Screw (1)	(31245) 4400A55-06		
Stud (2)	(31245) 4400A55-05		
Nut (4)	(31245) 7012-034		
Washer (2)	(31245) 7014-027		
Socket	(31245) 45500-752-12	Fig. 42-2 Fig. 42-4 Para 71	Spur and finger gear removal
Wrench	(31245) 45500-752-04	Fig. 42-13 Para 71	Countershaft bearing installation and removal
Bearing Puller Consists of:			
Puller plate (2)	(31245) 1376-036-01	Fig. 40-6 Para 67	Screen vibrator unit bearing removal
Puller ring (1)	(31245) 1376-036-02		
Capscrew (3)	(31245) 7026-007		
Bolt (6)	(31245) 7146-16		
Adjusting Bolt (1)	(31245) 3100A60L-01		
Long Mounting Tool	(31245) 1376-036-03	Fig. 40-8 Para 67	Screen vibrator unit bearing installation
Short Mounting Tool	(31245) 1376-036-04	Fig. 40-10 Para 67	Screen vibrator unit bearing installation

6. Direct and General Support and Depot Maintenance Repair Parts

Direct and General Support and Depot Maintenance Repair Parts are listed and illustrated in TM 5-3820-233-35P.

7. Specially Designed Tools and Equipment

The specially designed tool illustrated in figure

2 and listed in Table 4 is for direct support and general support and depot maintenance personnel performing major overhaul work on the Portable Secondary Crushing and Screening Plant. The tool listed in Table 4 is not available for issue, but must be fabricated by qualified direct and general support and depot maintenance personnel. No specially designed equipment is required.

Table 4. Specially Designed Tools and Equipment

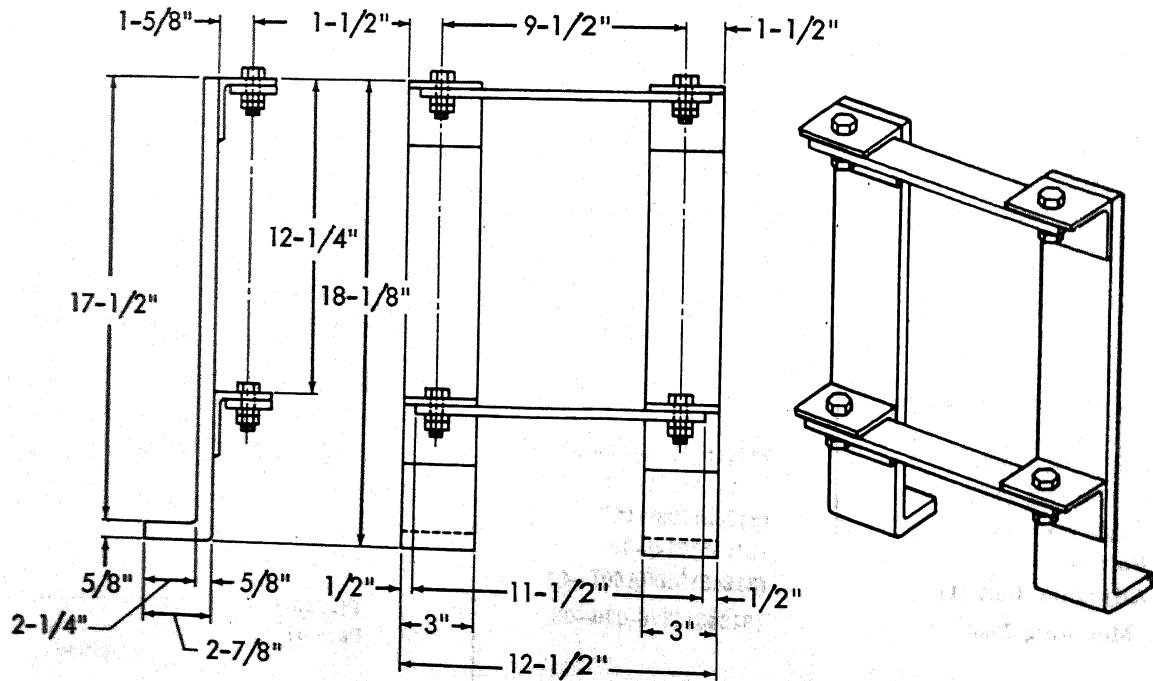
Item	Reference		Use
	Figure	Paragraph	
Roll shell assembly tool	2 and 42-10	72	Assembly of roll sheets

Section II. TROUBLESHOOTING

8. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the crushing and screen-

ing plant or any of its components. Each trouble stated is followed by a list of probable causes of trouble. The possible remedy recommended is described opposite the probable cause.



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Figure 2. Specially designed tool.

• Erratic Engine Operation

Probable cause	Possible remedy
Faulty injectors	Check the injector timing and position on injector racks (Operator's Manual).
Low compression pressure.	Replace piston and piston rings (para 46). Replace cylinder head gasket (para 43). Replace valve seats (para 43). Replace injector tubes (para 41).

• Engine Lacks Power

Probable cause	Possible remedy
Piston assemblies worn	Replace piston assemblies (para 46).
High engine temperature caused by defective water pump.	Repair defective water pump (para 34).
Improper gear train timing.	Time gear train (para 51).

• Engine Will Not Turn

Probable cause	Possible remedy
Engine is locked or seized	Disassemble engine to determine the cause and replace necessary parts.

• Low Cranking Speed

Probable cause	Possible remedy
Arter brush springs weak.	Check brush spring tension, replace springs if necessary (para 30).
Arter commutator dirty or worn.	Polish commutator, machine commutator and under-cut mica if necessary (para 30).
Arter armature burned out.	Replace armature (para 30).

• Engine Hard to Start

Probable cause	Possible remedy
Exhaust valves sticking or burned.	Check for bent valve guide and replace if necessary (para 43). Check for defective valve spring and replace if necessary (para 43). Clean and reface valve (para 43).
Impression rings worn or broken.	Replace rings (para 46).

Probable cause	Possible remedy
Cylinder head gasket leaking.	Replace gasket (para 43).
Improper valve clearance	Check exhaust valve clearance and adjust to the correct clearance (Operator's Manual).
Blower inoperative	Inspect blower drive shaft and coupling, and replace parts if necessary (para 37).
Insufficient fuel	Clean injector spray tip orifices (para 41). Replace injector spray tips (para 41). Replace injector plunger and bushing assembly (para 41). Time injector rack and gear (Operator's Manual).
Worn fuel pump gears or pump housing.	Replace gear and shaft assembly in pump body (para 36).
Fuel pump not rotating	Check blower drive, if broken, replace necessary parts (para 37). Check fuel pump drive gear and shaft, if broken, replace necessary parts (para 36). Replace fuel pump (Operator's Manual).

14. Low Oil Pressure

Probable cause	Possible remedy
Poor circulation	Remove and clean oil cooler core (Operator's Manual). Replace oil cooler by-pass valve (Operator's Manual). Replace oil pressure regulator valve (Operator's Manual).
	Check if gallery, crankshaft or camshaft plugs are missing and replace if parts are missing.
Faulty oil pump	Replace oil pump (para 45).
Dirty oil pump inlet screen.	Clean screen (para 45)

15. Engine Overheats

Probable cause	Possible remedy
Improper engine lubrication.	Check for proper operation of engine oil pump (para 45).

Probable cause	Possible remedy
Poor circulation	Check water pump for a loose or damaged impeller, and replace parts if necessary.
Damaged radiator	Replace radiator (para 33).

16. Power-Take Off Clutch Slips

Probable cause	Possible remedy
Clutch adjustment necessary.	Adjust clutch refer to Operator's Manual.
Worn clutch facing	Replace clutch facing (para 47).

17. Conveyor Belt Running Off Center

Probable cause	Possible remedy
Troughing roll assembly not positioned correctly in frame.	Move one end of troughing roll assembly to change belt travel to center on troughing roll assembly. Refer to Operator's Manual.
Spillage of material	Adjust to eliminate spillage.
Plant operating in un-level position.	Level complete plant.
Troughing and return roller not rotating.	Free rolls or replace defective rolls if necessary.
Head or tail pulley moved.	Center pulley and securely lock into position with the taper lock bushings.

18. Conveyor Belt Slipping

Probable cause	Possible remedy
Insufficient conveyor belt tension.	Tighten conveyor belt. Refer to Operator's Manual.
Drive pulley lagging worn.	Replace lagging. Refer to Operator's Manual.
Troughing or return roll assemblies not rotating freely.	Free roll assemblies or replace if necessary.
Insufficient V-belt drive tension.	Check drive and tighten V-belts if necessary.

Section III. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

23. Power Unit

a. Removal

- (1) Remove the power unit-to-main countershaft guard (Operator's Manual).
- (2) Disconnect the fuel lines from the engine (Operator's Manual).

19. Conveyor Clutches Slip

Probable cause	Possible remedy
Worn driving plates	Adjust clutch refer to Operator's Manual. Replace driving plates.

20. Roll Shaft Bearings Overheat

Probable cause	Possible remedy
Excessive or insufficient lubricant.	Refer to Operator's Manual.
Loose stationary roll shaft bearing housing screws.	Tighten screws (para 72).
Tension springs need adjustment.	Adjust tension springs (para 72).
Bearings damaged during welding operations.	Replace bearings (para 42).
Worn bearings	Always ground component being welded Replace bearings (para 42).

21. Excessive Roll Shell Wear

Probable cause	Possible remedy
Feeding oversize material in proportion to crusher discharge opening.	Reduce size of material to roll crusher. Refer to Operator's Manual for size of feed.
Adjust discharge opening (para 72).	Weld worn area (para 72).

22. Screen Vibrator Unit Bearings Overheat

Probable cause	Possible remedy
Excessive or insufficient lubricant.	Refer to Operator's Manual.
Broken coil spring	Replace spring (para 67).
Loose drive shaft nut	Tighten drive shaft nut (para 68).
Excessive speed	Refer to para 67 and Operator's Manual.
Dirty or plugged gear case breather.	Remove and clean breather.

(3) Disconnect the battery cables.

(4) Loosen adjusting bolts and remove V-belts.

(5) Refer to figure 3 and remove the power unit.

b. Installation

(1) Refer to figure 3 and install the power unit.

(2) Turn jam nuts for desired belt tension.

Note. When making the belt tension adjustment be sure the power unit clutch drive shaft is parallel with the main countershaft.

(3) Connect battery cables.

Note. Connect negative (-) battery terminal last.

(4) Connect fuel lines (Operator's Manual).

(5) Install the power unit-to-main countershaft guard (Operator's Manual).

24. Rock and Sand Conveyors*a. Rock Conveyor Removal*

Note. If the conveyor is in the folded position, refer to the Operator's Manual and lower the conveyor.

(1) Refer to the Operator's Manual and remove the conveyor belt.

(2) Attach a suitable lifting device to the conveyor frame.

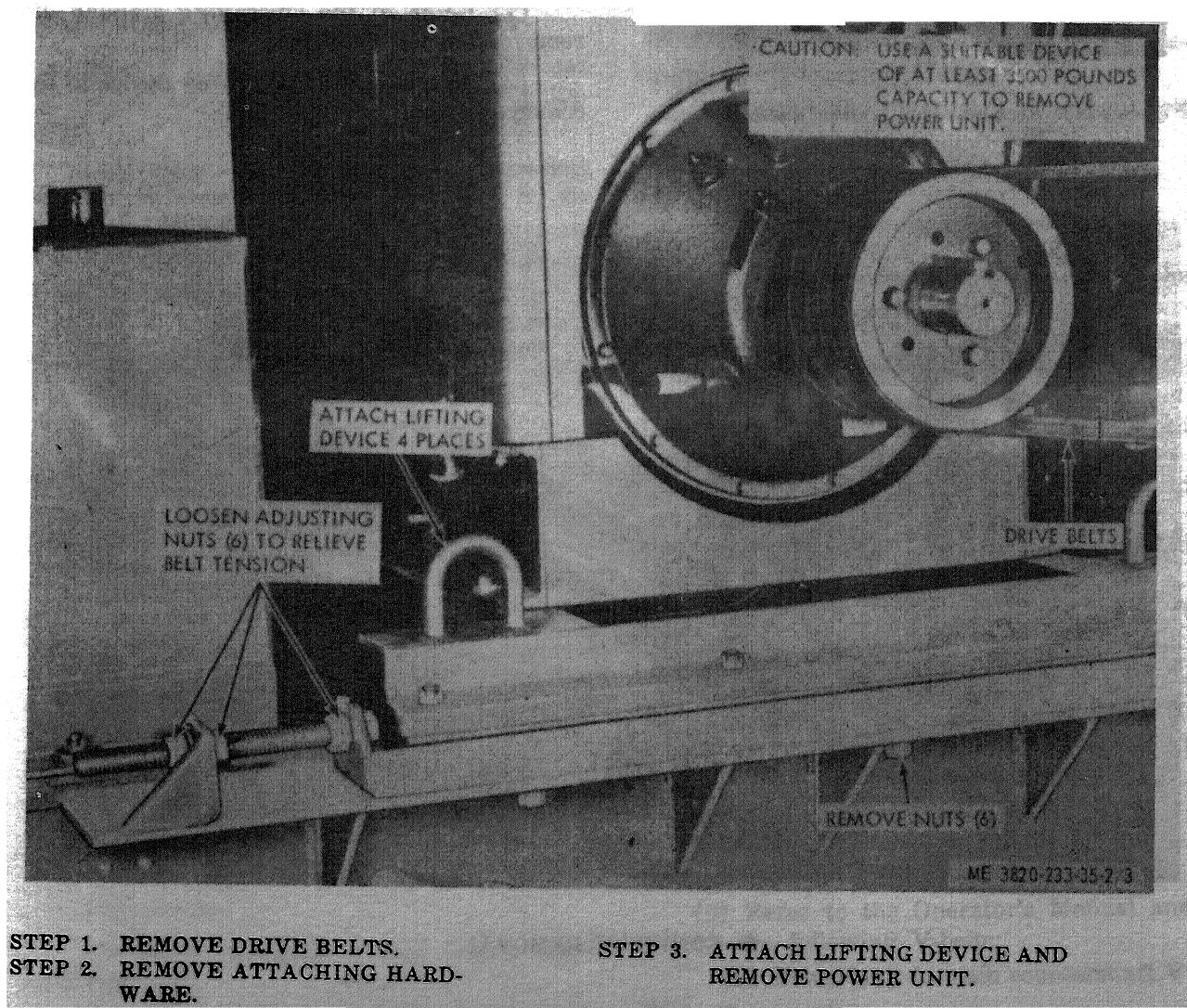


Figure 3. Power unit, removal and installation.

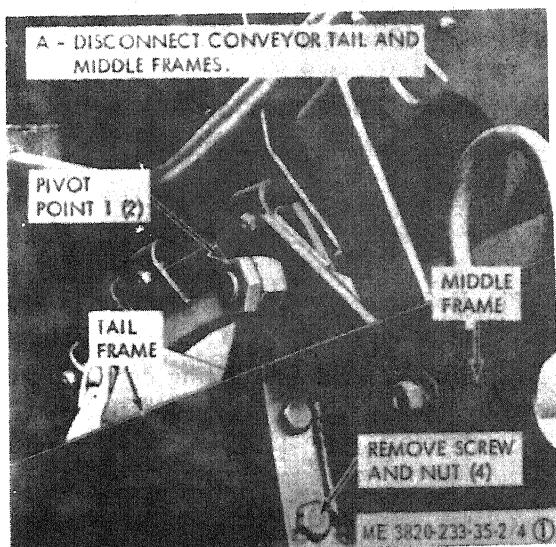


Figure 4 (1). Rock conveyor, removal and installation.

(3) Release the hoisting cable from the overhead idler pulleys (fig. 4).

(4) Remove the hoisting cable from the head and center cable pulleys (fig. 4B) and turn winch to remove cable slack.

(5) Disconnect conveyor middle frame from the conveyor tail frame (fig. 4A).

(6) Disconnect conveyor pivot points 1 and 2 (fig. 4).

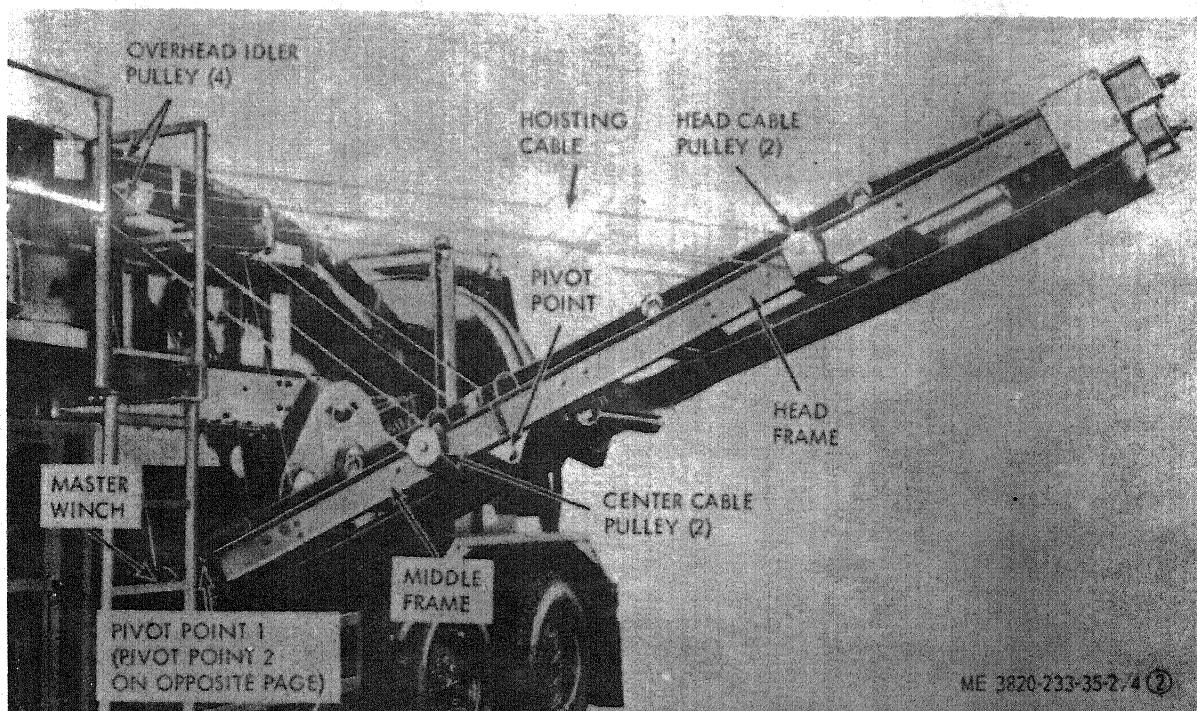
(7) Remove conveyor from the plant.

b. Sand Conveyor Removal

Note. If the conveyor is in the folded position refer to the Operator's Manual and lower the conveyor.

(1) Refer to the Operator's Manual and remove the conveyor belt.

(2) Attach a suitable lifting device to the conveyor frame.



B—CONVEYOR REMOVAL.

Figure 4 (2)—Continued.

(3) Release the hoisting cable from the slave winch (fig. 4), and unwrap cable from the overhead idler pulleys and conveyor cable head and center pulleys. Coil the cable and strap it to the conveyor.

(4) Disconnect conveyor middle frame from the conveyor tail frame (fig. 4).

(5) Disconnect conveyor pivot points 1 and 2 (fig. 5).

(6) Remove conveyor from the plant.

c. *Rock Conveyor Installation.* Reverse steps 1 through 7 under "Rock Conveyor Removal."

Note. String the hoisting cable as illustrated on figure 4. Refer to the Operator's Manual for conveyor folding instructions.

d. *Sand Conveyor Installation.* Reverse steps 1 through 6 under "Sand Conveyor Removal."

Note. String the hoisting cable as illustrated on figure 5. Anchor end of hoisting cable to the slave winch shown on figure 4.

Refer to the Operator's Manual for conveyor folding instructions.

25. Overhead Conveyor

a. Removal

(1) Remove the sand and rock conveyors (para 24).

(2) Remove the conveyor belt (Operator's Manual).

(3) Remove the main countershaft to overhead conveyor drive guard (Operator's Manual).

(4) Remove the overhead conveyor drive belts (Operator's Manual).

(5) Refer to figure 6 and remove overhead conveyor.

Note. The conveyor tail frame removal instructions will be discussed under elevating wheel assembly removal (para 26).

b. Installation

(1) Refer to figure 6 and install overhead conveyor.

(2) Install conveyor belt (Operator's Manual).

(3) Install sand and rock conveyors (para 24).

(4) Adjust overhead conveyor drive belt tension (Operator's Manual).

26. Elevating Wheel Assembly

a. Removal

(1) Remove the overhaul conveyor belt (Operator's Manual).

(2) Remove the undercrusher and elevating wheel drive guard (Operator's Manual).

(3) Refer to figure 7 and remove the conveyor hopper, conveyor tail frame, and elevating wheel as an assembly.

b. Installation

(1) Refer to figure 7 and install the elevating wheel assembly.

(2) Install the overhead conveyor belt (Operator's Manual).

27. Vibrating Screen

a. Removal

(1) Place a suitable support under the rock and sand conveyors to hold them in operating position.

(2) Release the hoisting cable from the overhead idler pulleys (para 24).

(3) Refer to the Operator's Manual and remove the overhead conveyor belt.

(4) Remove the overhead conveyor head and intermediate frames (para 25).

(5) Refer to the Operator's Manual and remove the following guards:

(a) Power unit-to-main countershaft drive guard.

(b) Main countershaft-to-overhead conveyor drive guard.

(c) Screen and screen countershaft guard.

(d) Main drive center guard.

(e) Main countershaft-to-lower countershaft guard.

(6) Refer to the Operator's Manual and remove the following V-belts:

(a) Power unit-to-main countershaft V-belts.

(b) Overhead conveyor drive V-belts.

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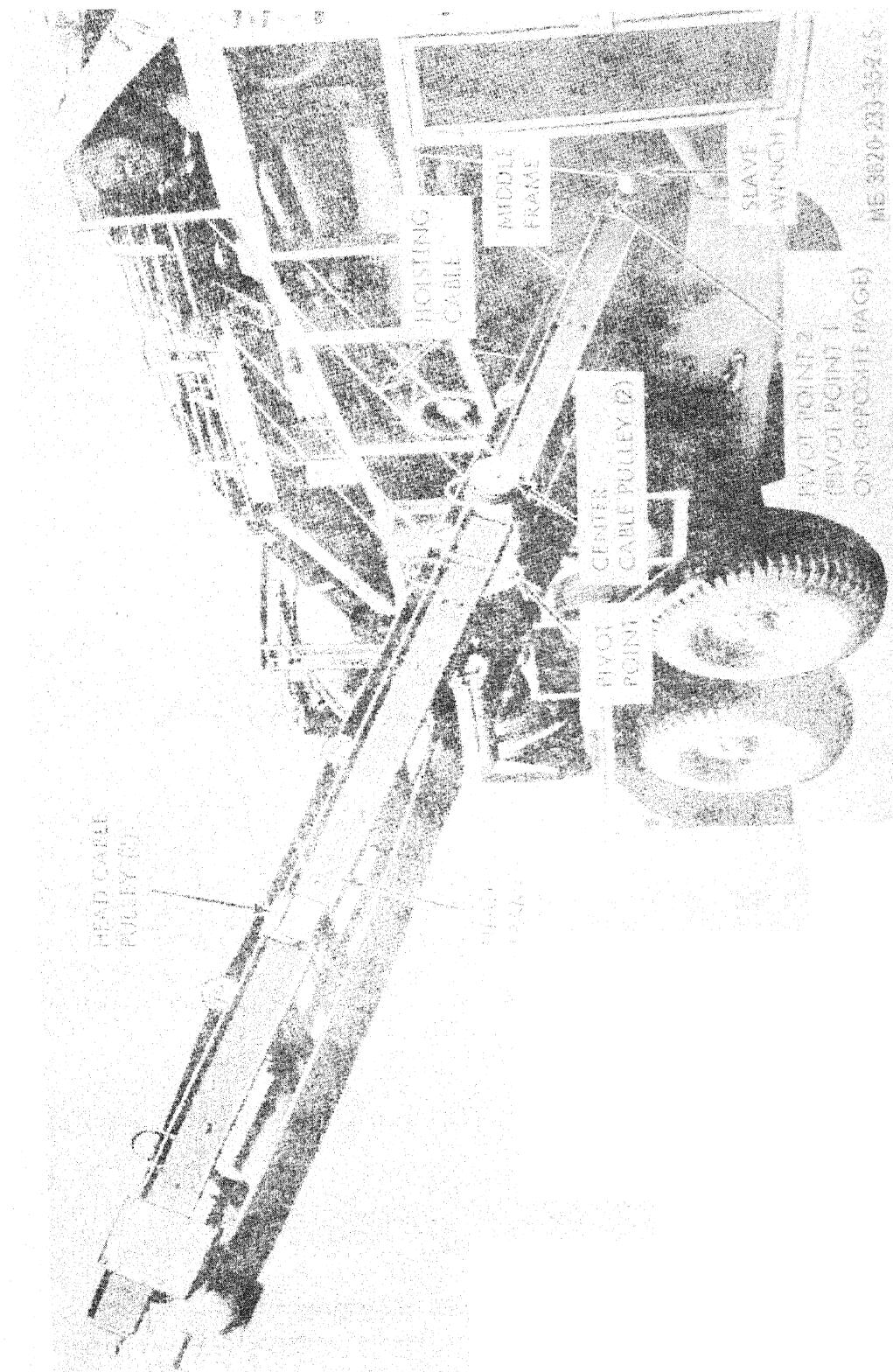
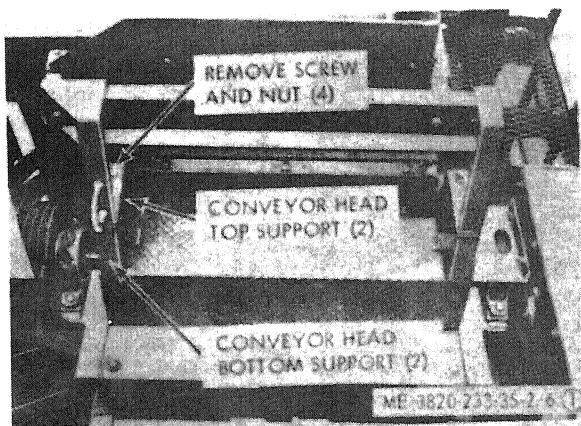


Figure 5. Sand conveyor, removal and installation.



STEP 1. DISCONNECT CONVEYOR HEAD TOP SUPPORTS FROM CONVEYOR HEAD BOTTOM SUPPORTS.

Figure 6 (1). Overhead conveyor, removal and installation.

(c) Screen vibrating unit-to-screen countershaft drive V-belts.

(d) Roll crusher drive V-belts.

(e) Main countershaft-to-lower countershaft V-belts.

(7) Refer to figure 8 and remove the vibrating screen.

b. Installation

(1) Refer to figure 8 and install the vibrating screen.

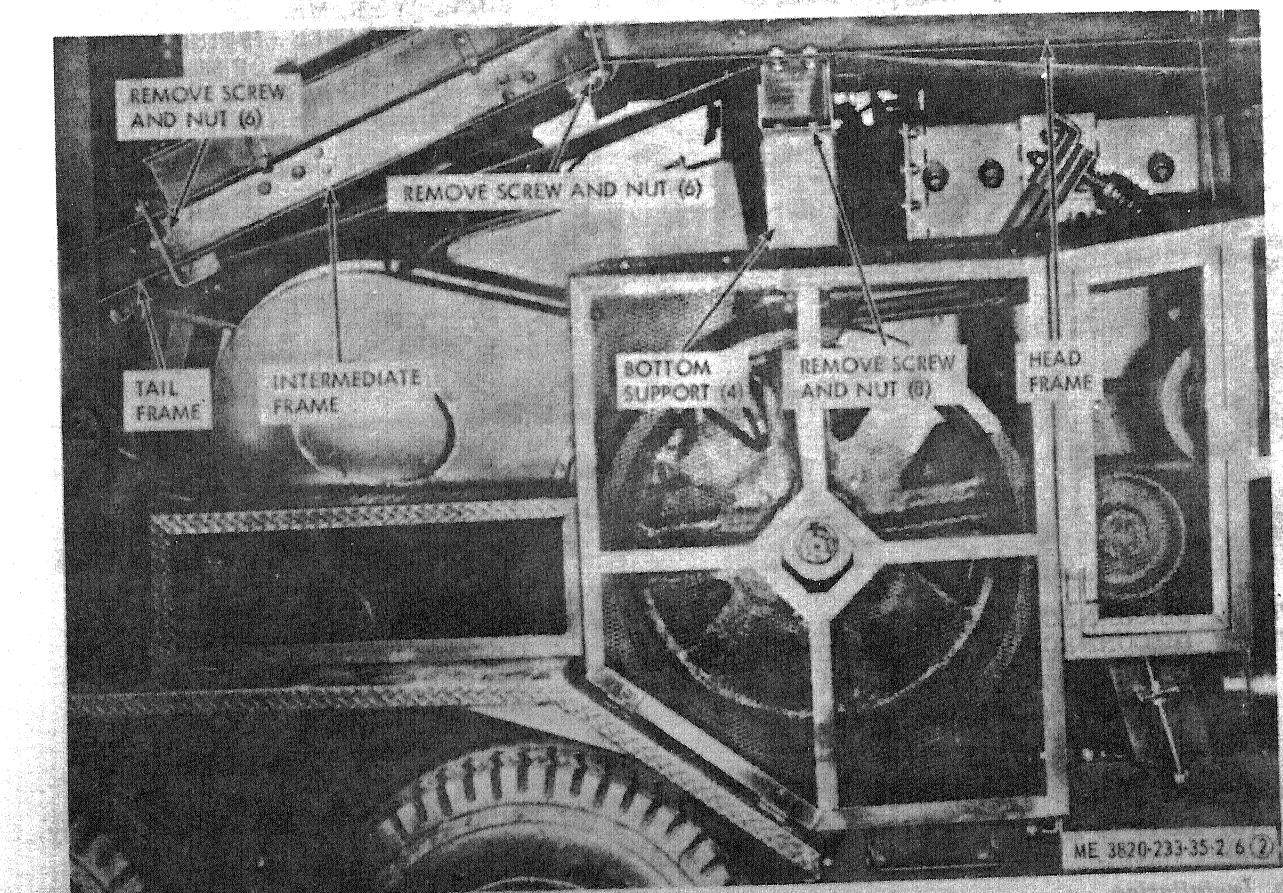
(2) Complete the vibrating screen installation in the reverse numerical sequence as discussed under "Vibrating Screen Removal."

(3) Refer to the Operator's Manual and make the proper belt tension adjustments.

28. Roll Crusher

a. Removal

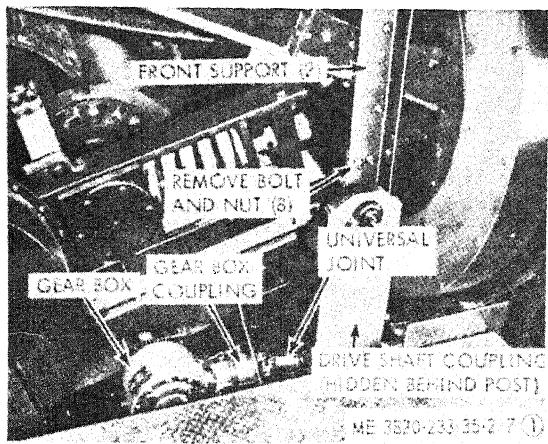
(1) Remove the overhead conveyor belt and intermediate frame (para 25).



STEP 2. DISCONNECT INTERMEDIATE FRAME FROM TAIL FRAME AND HEAD FRAME, AND REMOVE FROM PLANT.

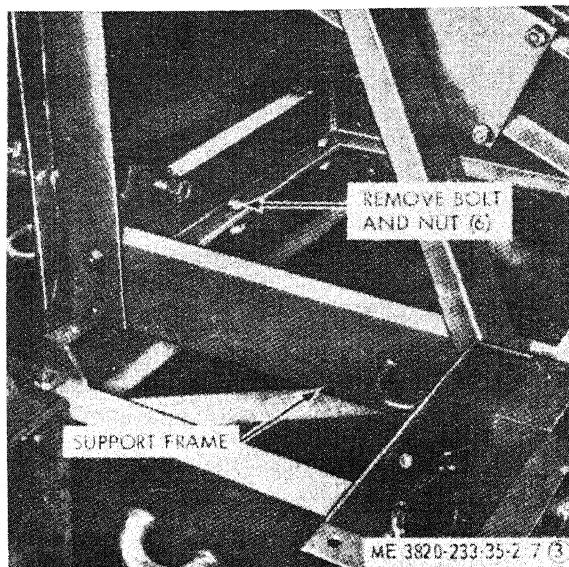
STEP 3. DISCONNECT HEAD FRAME FROM BOTTOM SUPPORTS AND REMOVE HEAD FRAME.

Figure 6 (2)—Continued.



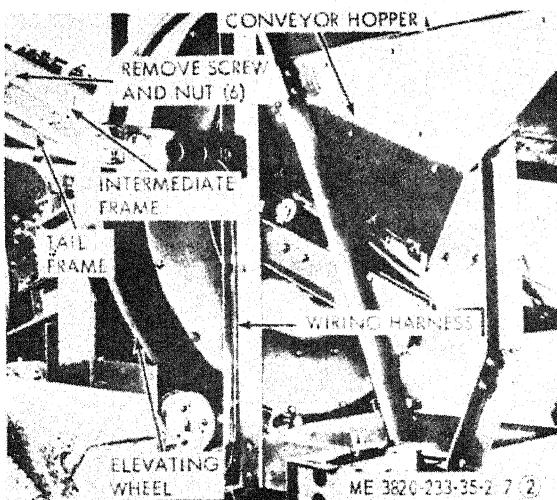
STEP 1. DISCONNECT DRIVE SHAFT COUPLING FROM TRUNNION SHAFT.
 STEP 2. DISCONNECT ELEVATING WHEEL FRONT SUPPORTS.

Figure 7 (1). Elevating wheel, removal and installation.



STEP 5. DISCONNECT ELEVATING WHEEL SUPPORT FRAME.
 STEP 6. USE A SUITABLE LIFTING DEVICE WITH A CAPACITY OF 3300 POUNDS AND REMOVE ELEVATING WHEEL ASSEMBLY.

Figure 7 (3)—Continued.



STEP 3. DISCONNECT WIRE HARNESS.
 STEP 4. DISCONNECT TAIL FRAME FROM INTERMEDIATE FRAME.

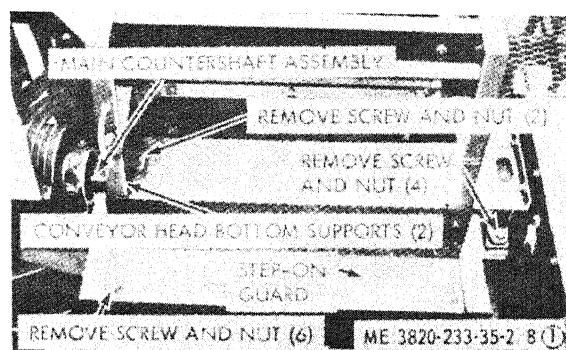
Figure 7 (3)—Continued.

(2) Remove the elevating wheel assembly (para 26).

(3) Refer to figure 9 and remove the roll crusher.

b. Installation

(1) Refer to figure 9 and install the roll crusher.



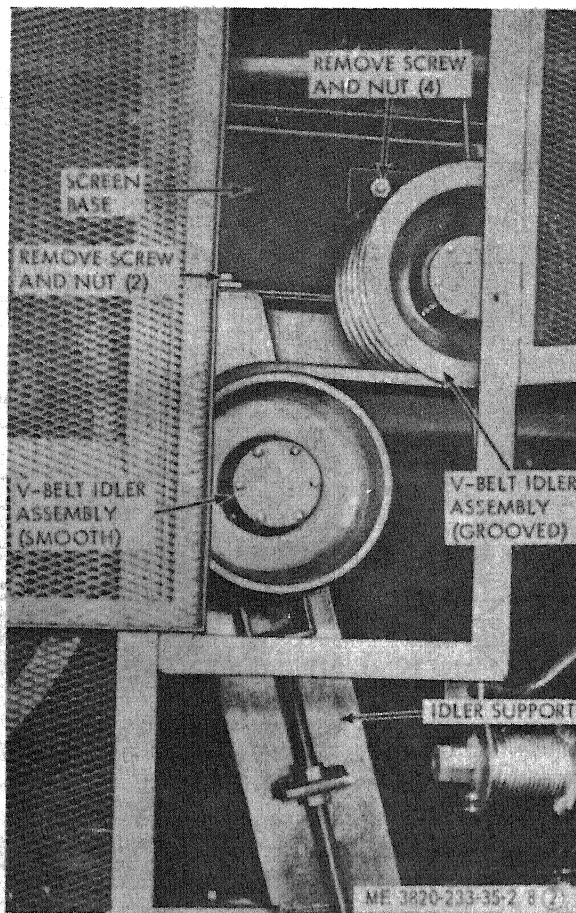
STEP 1. REMOVE STEP-ON GUARD.
 STEP 2. REMOVE CONVEYOR HEAD BOTTOM SUPPORTS.
 STEP 3. REMOVE THE MAIN COUNTERSHAFT ASSEMBLY.

Figure 8 (1). Vibrating screen, removal and installation.

(2) Install the elevating wheel assembly (para 26).

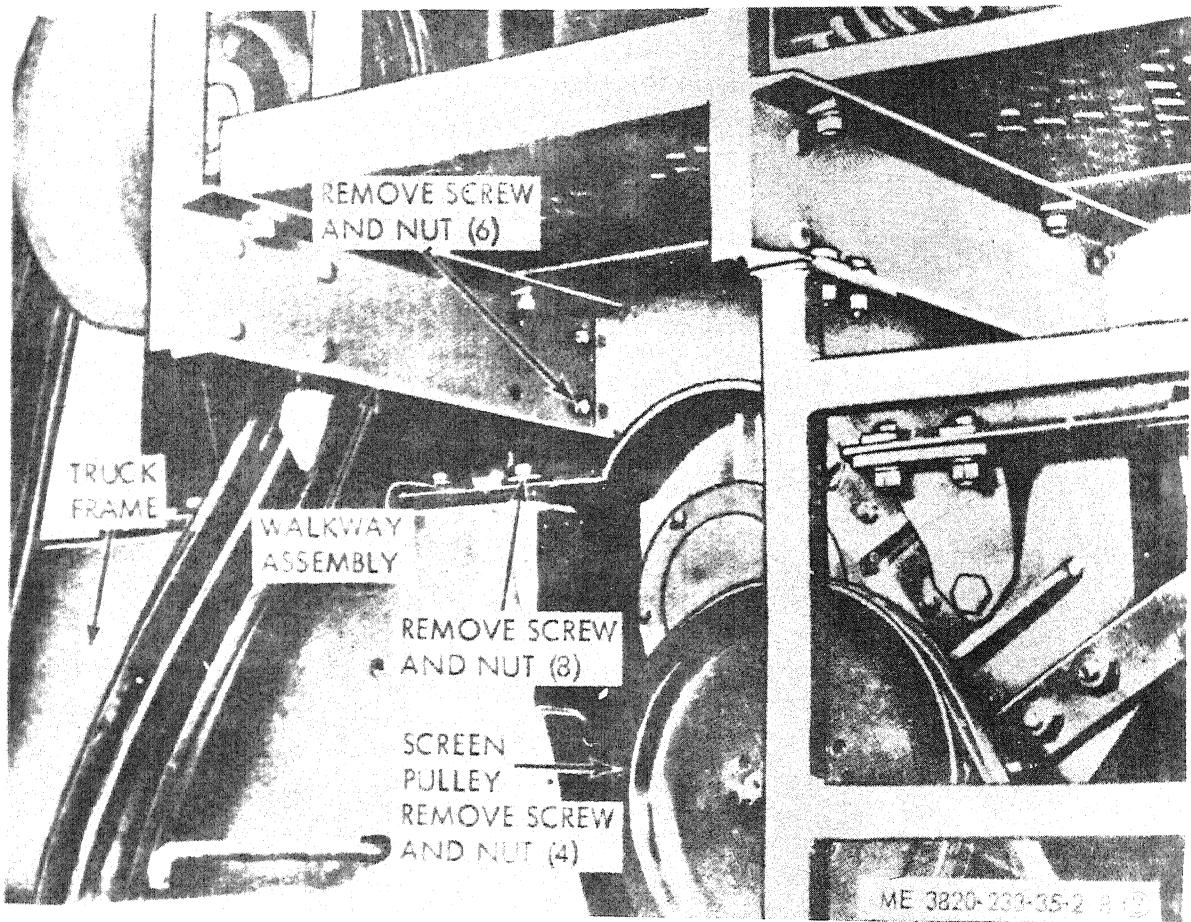
(3) Install the overhead conveyor intermediate frame (para 25).

(4) Refer to the Operator's Manual and adjust V-belts.



**STEP 4. REMOVE V-BELT IDLER ASSEMBLY (GROOVED).
DISCONNECT IDLER SUPPORT FROM SCREEN BASE.**

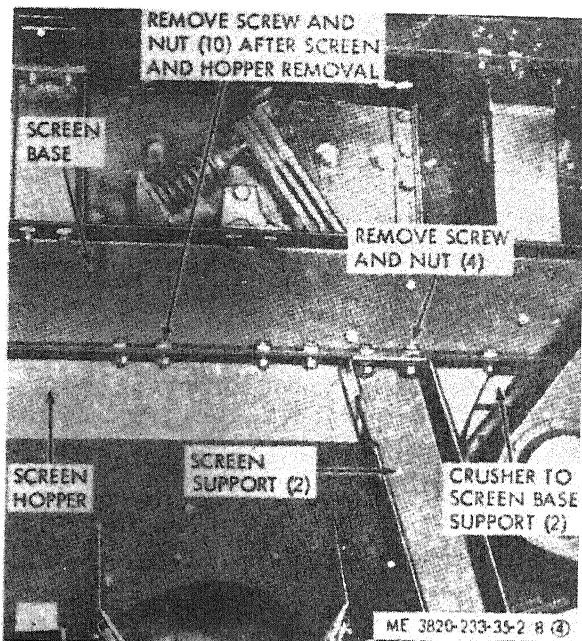
Figure 8 (2)—Continued.



STEP 5. REMOVE WALKWAY ASSEMBLY.
STEP 6. DISCONNECT SCREEN FROM
TRUCK FRAME.

STEP 7. REMOVE THE SCREEN PULLEY.

Figure 8 (3)—Continued.



STEP 8. DISCONNECT SCREEN BASE AND HOPPER FROM THE SCREEN SUPPORTS.

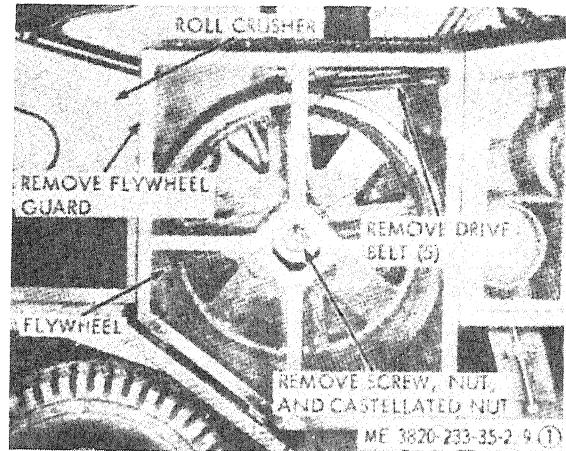
STEP 9. DISCONNECT SCREEN BASE FROM CRUSHER-TO-SCREEN BASE SUPPORT.

STEP 10. ATTACH A SUITABLE LIFTING DEVICE WITH A CAPACITY OF 6200 POUNDS, AND REMOVE THE SCREEN AND HOPPER.

STEP 11. LOWER THE SCREEN AND HOPPER ONTO A STURDY SUPPORT, AND DISCONNECT THE HOPPER FROM THE SCREEN BASE.

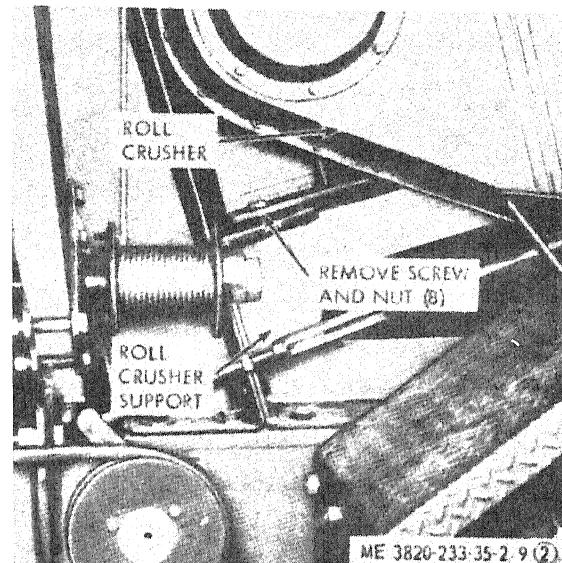
STEP 12. LIFT SCREEN AND VIBRATING UNIT CLEAR OF THE HOPPER

Figure 8 (4)—Continued.



STEP 1. REMOVE FLYWHEEL.

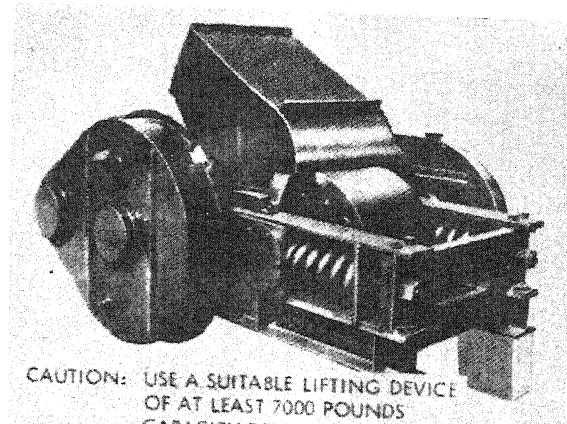
Figure 9 (1). Roll crusher, removal and installation.



STEP 2. REMOVE THE ROLL CRUSHER-TO-SCREEN BASE SUPPORT SHOWN ON FIGURE 8.

STEP 3. DISCONNECT ROLL CRUSHER FROM THE ROLL CRUSHER SUPPORT.

Figure 9 (2)—Continued.



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STEP 4. REMOVE ROLL CRUSHER FROM
PLANT.

Figure 9 (3)—Continued.

CHAPTER 3

ENGINE REPAIR INSTRUCTIONS

Section I. ENGINE ACCESSORIES

29. General

This section contains those items which are considered accessories to the engine. They consist of the starter, battery-charging generator, radiator, water pump, hydraulic governor, fuel pump, blower, blower drive, and overspeed governor.

30. Starter

a. *General.* The starter is a 24 volt, 4-brush, gear drive type. The starter converts the electrical energy of the batteries into the mechanical energy necessary to crank the engine. The starter incorporates an overrunning clutch which shifts the starting motor pinion into mesh with the flywheel ring gear.

b. *Removal.* Refer to Operator's Manual.

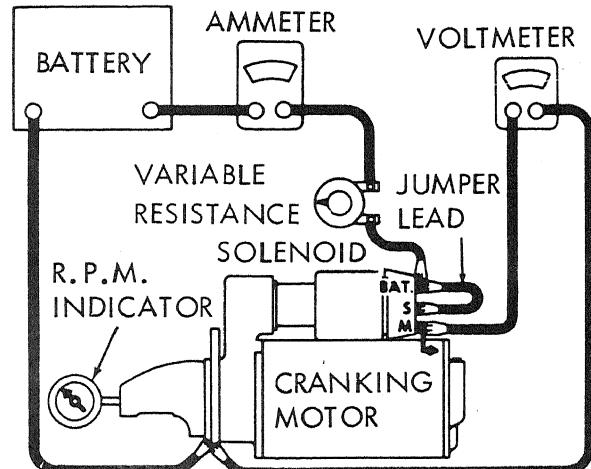
c. *Bench Testing*

Note. Never operate the cranking motor more than 30 seconds at a time without pausing to allow it to cool at least two minutes.

(1) The armature should be checked for freedom of operation by turning the drive. Tight, dirty, or worn bearings, bent armature shaft, or loose pole shoe screw will cause the armature to drag and it will not turn freely.

(2) *No-Load Test* (fig. 10-1)

(a) Connect the cranking motor in series with a fully charged battery to provide 24 volts, an ammeter capable of reading several hundred amperes, and a variable resistance. Also connect a voltmeter as illustrated, from the motor terminal to the motor frame. An rpm indicator is necessary to measure armature speed. Proper voltage can be obtained by varying the resistance unit.



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VOLTS	MIN. AMPS	MAX. AMPS	MIN. R.P.M.	R.P.M. MAX.
23.0	60*	90*	7000	10700

*INCLUDES SOLENOID

Figure 10-1. No load test.

(b) Rated current draw and no-load speed indicates normal condition of the cranking motor.

(c) Low free speed and high current draw indicates: tight, dirty, or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag, shorted armature, grounded armature or fields.

(d) Failure to operate with high current draw indicates a direct ground in the terminal or fields.

(e) Failure to operate with no current draw indicates an open field circuit, broken brush springs, worn brushes, high insulation be-

tween the commutator bars or other causes which would prevent good contact between the brushes and commutator.

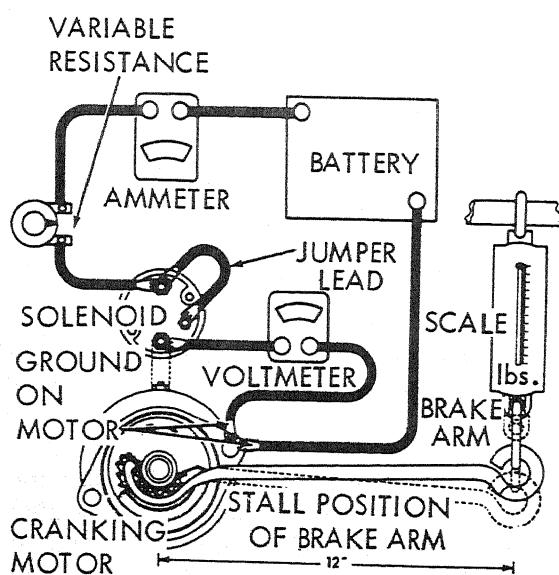
(f) Low no-load speed and low current draw indicate a high internal resistance due to poor connections, defective leads, dirty commutator and causes listed under (e).

(g) High free speed and high current draw indicate shorted fields.

(3) Lock-Torque Test (fig. 10-2). The lock-torque test requires the equipment illustrated. A variable resistance with a high current capacity should be used. The cranking motor should be SECURELY mounted and a brake arm hooked to the drive. When specified current is applied, the torque can be computed from the reading on the scale. A one foot brake arm will directly indicate foot-pound. If the torque is low, the motor must be disassembled for further tests and repair.

d. Disassembly.

(1) Scribe marks across drive housing, fever housing, frame and end bell to facilitate reassembly in the correct relationship.



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AMPS	MIN. TORQUE (LB-FT)	APPROX. VOLTS
500	26	3.5

Figure 10-2. Lock test.

(2) Refer to figure 10-3 and disassemble the starter.

e. Cleaning.

(1) The drive, armature and fields should not be cleaned in any degreasing tank, or with grease dissolving solvents, since these would dissolve the lubricant in the drive and damage the insulation in the armature and field coils. All parts except the drive should be cleaned with oleum spirits and a brush. The drive can be wiped with a clean cloth.

(2) If the commutator is dirty it may be cleaned with No. 00 sandpaper.

Caution: Never use emery cloth to clean commutator.

f. Inspection and Repair.

(1) Inspect housings and frames for cracks and distortion. Inspect threads in tapped holes for damage. Replace defective parts.

(2) Inspect sleeve bearings for wear. Replace bearing if defective. Check for looseness in housing or end bell. Replace worn or defective bearings. If new bearing is loose in bore, replace housing or end bell.

(3) Inspect wicks for tests, fraying, or wear. Replace if defective.

(4) Turn down commutator if grooved or out of round. Undercut mica to a depth of 0.025 to 0.032 inch below surface of commutator. Do not widen slots when undercutting mica.

(5) Inspect drive pinion for broken or badly worn teeth. Inspect clutch splines for wear and damage. Inspect shell for cracked or broken condition. Check to make sure pinion will drive into one direction and will slip in opposite direction. Replace drive clutch if defective.

(6) Inspect shift lever, shaft, and solenoid plunger for cracks or distortion. Replace defective parts.

(7) Inspect bellows for tears, punctures, and deterioration.

(8) Inspect solenoid relay case for cracks or other damage. Replace if defective.

(9) Inspect brushes for wear or damage. If damaged, or worn excessively, replace them.

g. Testing.

(1) To test armature for grounds or short, refer to TM 5-764.

(2) To test field coil windings for open circuits, connect multimeter probes to the ends of field coil, if multimeter does not read field coil is open and should be replaced.

(3) To test field coil windings for grounds, disconnect field coil winding ground connection. Connect meter probes to field frame and field connector, if multimeter reads, field coil is grounded, and must be repaired or replaced.

h. Assembly of End Bell and Brush Holder Plate.

(1) If wick was removed during disassembly, saturate a new wick and plug with oil and install in end bell. Wick must not be in fill hole.

(2) Apply sealer to expansion plug hole and install plug. Fill reservoir with oil and install pipe plug.

(3) If bushing was removed, press a new bushing in end bell and install expansion plug.

(4) Assemble brush holder plate and end bell in the reverse order of disassembly but do not install brushes.

i. Starter Reassembly (fig. 10-3)

(1) If wicks were removed during disassembly, install wicks and plugs following same instructions specified for end bell ((1) and (2) above).

(2) If bushings were removed, press new bushings into housing.

(3) Assemble starter in reverse order of disassembly with the following exceptions and additions.

(4) If field windings were removed, coat threads of pole shoes screws with a suitable thread sealer before installation. Varnish inside of frame and winding assembly. Leave 0.38 inch from each end of frame free of varnish.

(5) Partially install lever housing, lever, and solenoid plunger before installing drive clutch. With frame in vertical position and lever housing upward, install nonmetallic washer and install drive clutch. Tilt clutch to engage lugs on shift lever. Seat housing making sure bellows is not crimped.

(6) If new brushes are being installed, cover commutator with No. 00 sandpaper temporarily install armature, brushes, and end bell

and turn in brushes. Disassemble, remove sandpaper, and clean armature and brush holder plate assembly.

(7) Install thrust washer on armature shaft and install preformed packing on end bell. Install end bell assembly with assembled brush holder assembly on commutator and install brushes. Install flat washer on armature shaft and install armature and end bell as a unit into frame.

j. Adjusting Drive Clutch Pinion Clearance.

(1) Remove plug.

(2) With starter pinion in engaged position, press clutch inward lever to take up slack.

(3) Adjust hex self-locking nut until clearance between outer face of pinion and inner face of housing overhaul is 23/64 inch \pm 1/32 inch.

k. Installation. Refer to Operator's Manual.

31. Generator—Battery Charging

a. General. The generator is a 24-volt 40 ampere type mounted on the front of the engine. It is fungus and corrosion resistant and is arranged for "B" type circuit with the field grounded inside the generator.

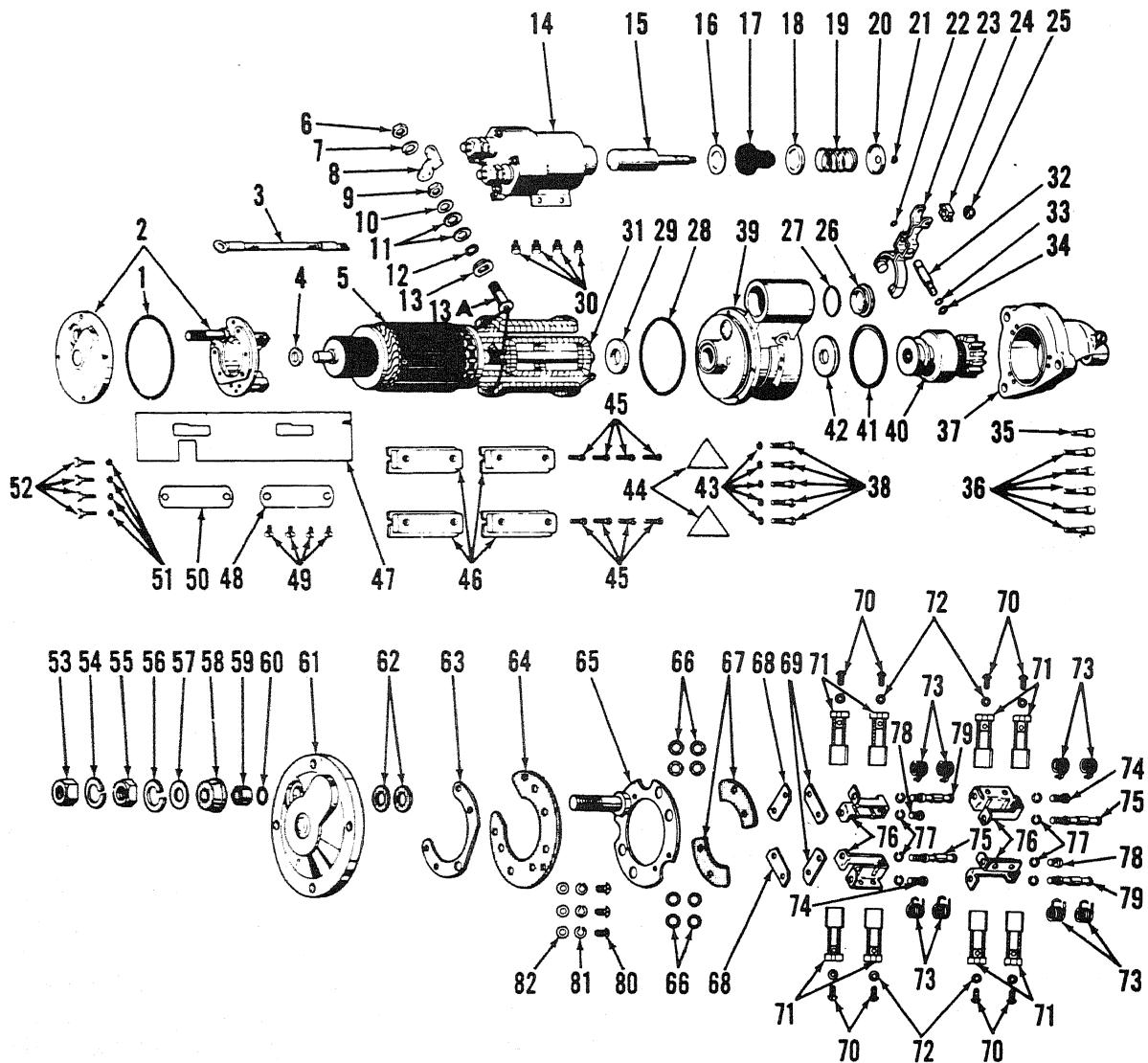
b. Removal. Refer to Operator's Manual.

c. Bench Testing. To check the generator for electrical output, connect an ammeter in series with a battery to the generator output terminal. Also connect a voltmeter from the generator output terminal to ground, and a load rheostat across the battery. Connect a jumper lead to the generator field terminal as shown in figure 11-1. Operate the generator at 1775 rpm, and adjust the lead rheostat to obtain a reading of 18 amperes on ammeter, and 28.5 volts on voltmeter. If the generator will not meet these conditions, it should be disassembled for further testing.

d. Disassembly. Refer to figure 11-2 and disassemble the generator.

e. Cleaning.

(1) Clean the armature and field windings of any dirt or magnetized particles. To remove grease and oil, apply a light coat of a safety type petroleum solvent such as MIL-T-6003, with a brush. Wipe clean, then use compressed air to remove any remaining dirt film. Do



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1	O-ring	9	Nut	16	Washer
2	Plate assembly	10	Washer	17	Boot
3	Terminal and lead	11	Washer	18	Retainer
4	Washer	12	Gasket	19	Spring
5	Armature	13	Bushing	20	Retainer
6	Nut	13A	Stud	21	Snap ring
7	Lockwasher	14	Switch	22	O-ring
8	Connector	15	Plunger assembly	23	Lever

Figure 10-3. Starting motor, exploded view.

24	Guide	44	Insulation	64	Plate
25	Nut	45	Screw	65	Plate and stub
26	Plug	46	Pole	66	Bushing
27	O-ring	47	Insulation	67	Plate
28	O-ring	48	Cover	68	Plate
29	Washer	49	Screw	69	Plate
30	Screw and washer	50	Gasket	70	Screw
31	Field coil	51	Washer	71	Brush
32	Lever	52	Screw	72	Lockwasher
33	O-ring	53	Nut	73	Spring
34	Snap ring	54	Lockwasher	74	Screw
35	Screw	55	Nut	75	Holder screw
36	Screw	56	Lockwasher	76	Holder
37	Housing	57	Washer	77	Lockwasher
38	Screw	58	Insulator	78	Screw
39	Housing	59	Bushing	79	Holder screw
40	Drive clutch assembly	60	O-ring	80	Screw
41	Gasket	61	Frame	81	Lockwasher
42	Washer	62	Washer	82	Washer
43	Lockwasher	63	Plate		

Figure 10-3—Continued

not use any degreasing compounds or submerge the armature in a degreasing tank as this would damage the insulation.

(2) Clean the commutator with 00 sandpaper and remove sand particles with compressed air.

(3) Clean the commutator end frame, drive end frame, and components with an approved solvent and dry thoroughly.

Caution: Do not soak insulators.

f. Inspection and Repair.

(1) Inspect the commutator for roughness, high mica, loose winding, burrs, or pits.

Smooth the commutator with 00 sandpaper or under cut on a lathe. Replace the armature if the commutator bars are less than 1/16-inch thick after undercut. Undercut the mica between the bars to a depth of 1/32-inch.

Caution: Do not widen commutator slots by removing metal from bars when undercutting. Use only solder with a rosin core flux.

(2) Inspect the armature shaft for wear, pits, bends, corrosion, or breaks.

(3) Place the armature ends in V-blocks and measure the commutator for out-of-round with a dial indicator. Turn down if in excess of 0.001-inch out-of-round.

(4) Inspect end frames for cracks and damaged or worn bearing surfaces.

(5) Inspect brush plate for cracks and loose rivets. Inspect insulated brush holders for grounds.

(6) Inspect brush springs for tension and signs of breaks or other damage. Replace brushes.

(7) Inspect the ball bearings for smooth operation. Inspect for excessive side play and damaged surfaces.

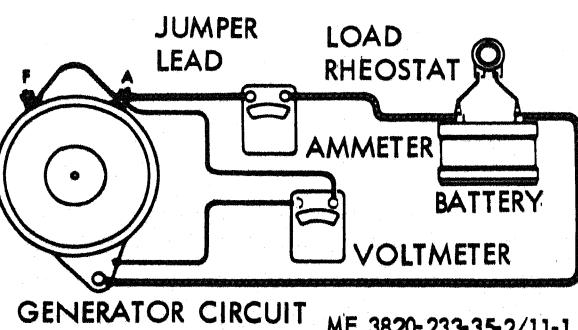
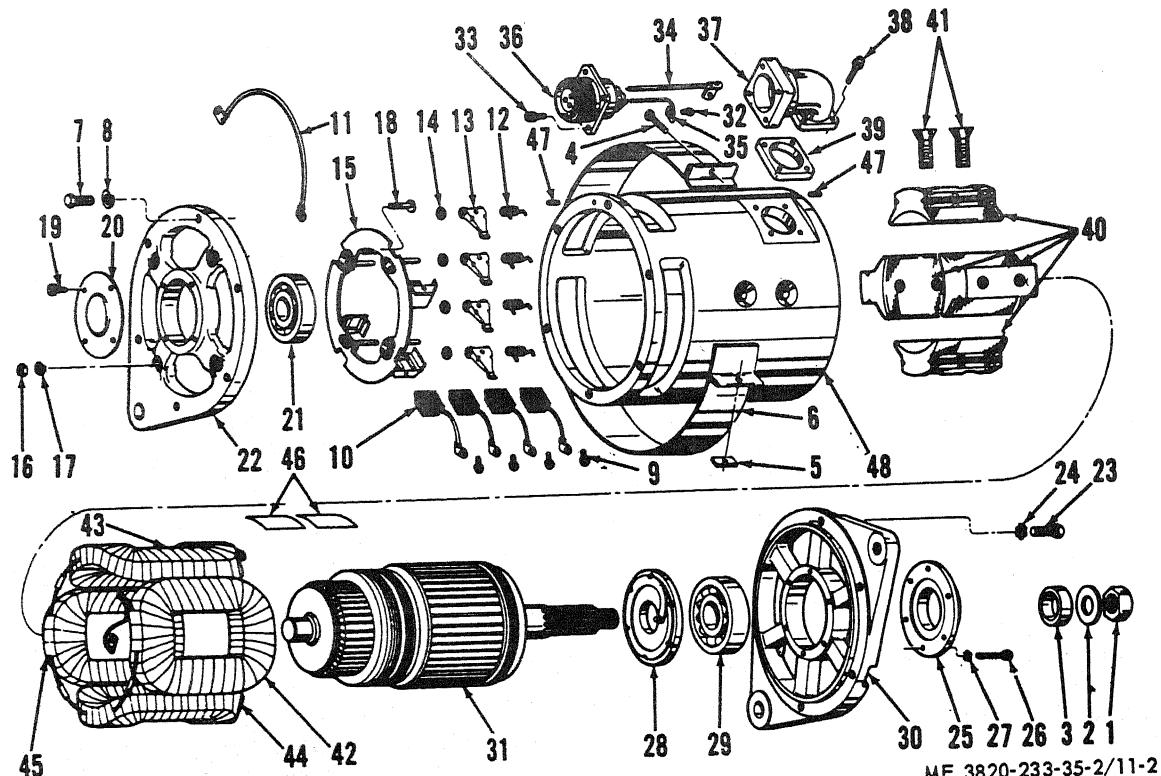


Figure 11-1. Connections for checking output on "B" circuit generators.



1 Nut
 2 Washer
 3 Collar
 4 Screw
 5 Nut
 6 Cover
 7 Screw
 8 Lockwasher
 9 Screw and washer
 10 Brush
 11 Lead assembly
 12 Spring
 13 Arm
 14 Washer
 15 Plate assembly
 16 Nut

17 Lockwasher
 18 Screw
 19 Screw
 20 Plate
 21 Bearing
 22 Frame
 23 Screw
 24 Lockwasher
 25 Plate
 26 Screw
 27 Lockwasher
 28 Plate
 29 Bearing
 30 Frame
 31 Armature
 32 Screw

33 Screw and washer
 34 Lead and clip
 35 Lead and clip
 36 Terminal
 37 Elbow
 38 Screw and washer
 39 Spacer
 40 Pole shoe
 41 Screw
 42 Coil
 43 Coil
 44 Coil
 45 Coil
 46 Insulator
 47 Pin
 48 Housing

Figure 11-2. Battery charging generator, exploded view.

(8) Inspect the generator field frame for breaks, cracks, and damaged threads.

(9) Inspect all hardware for damaged threads.

g. Testing.

(1) Inspect for windings grounded to core with a continuity tester. Touch one probe of the continuity tester to the armature shaft and the other

to each commutator riser. An indication of continuity indicates the armature is grounded.

(2) Inspect for open windings with a test lamp. Touch the probes to a pair of adjacent commutator risers. Failure of the lamp to light indicates an open winding.

(3) Inspect for shorts with a growler and steel strip. The steel strip will vibrate against

the armature over a shorted area as the armature is turned.

(4) Inspect the field windings for worn or frayed insulation, defective connections, opens, and field current draw.

(5) Replace or repair all defective parts as necessary.

h. Reassembly (fig. 11-2). Reassemble generator in direct reversal of disassembly. Seat brushes using a seating hone or sandpaper wrapped around commutator. Clean commutator thoroughly and complete assembly.

i. Installation. Refer to Operator's Manual.

32. Generator Regulator

a. General. The generator regulator (fig. 12-1) is a watertight, fungus and corrosion resistant unit for military applications. It is a heavy-duty, 24-volt, 40-ampere unit, designed for use in a negative grounded system and for generators having an internally grounded field circuit. Terminals of the regulator are housed in special receptacles conforming to Ordnance specifications. Connections to the regulator are made by means of mating Ordnance-type receptacles on the vehicle wiring harness.

b. Removal. Refer to Operator's Manual.

c. Regulator Maintenance.

(1) Test specifications for regulator Model 111 8858 are as follows.

Voltage Regulator:

Air gap (inches)	.084
Satisfactory operating range (volts)	13.9-14.9*
If outside range, adjust to (volts)	14.3*

Current Regulator:

Air gap (inches)	.115
Satisfactory operating range (amp.)	38-42*
If outside range, adjust to (amp.)	40*

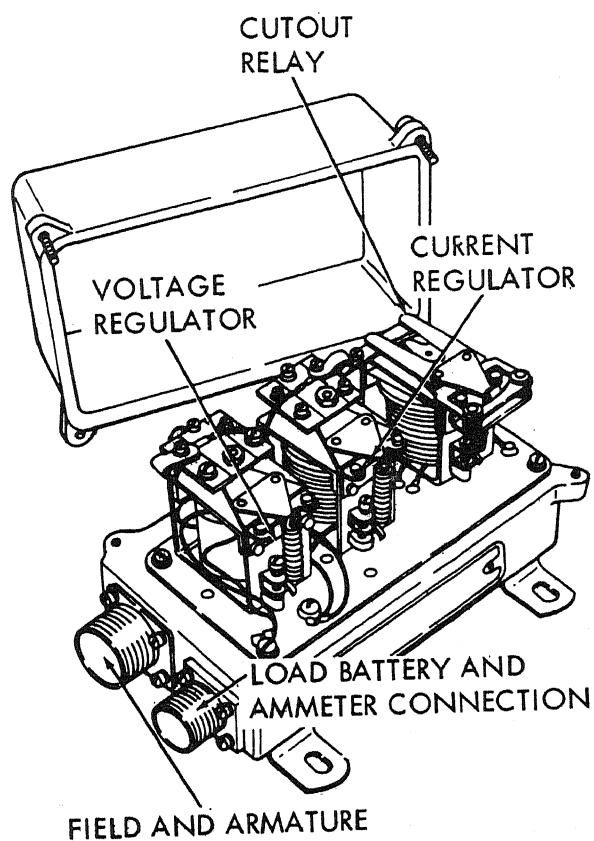
Cutout Relay:

Air gap (inches)	.048
Point opening (inches)	.035
Satisfactory closing range (volts)	11.8-13.4*
If outside range, adjust to (volts)	12.8*

Resistor Values (OHMS):

A	40 (2)
B	375 (2)
C	100 (1)
D	100 (2)
E	20 (1)

* These values apply only when the regulator is being tested at operating temperature, on the vehicle, and in accordance with the procedure described in the following section.



FIELD AND ARMATURE
CONNECTIONS

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Figure 12-1. Generator regulator with cover removed.

(2) Mechanical checks and adjustments (air gaps, point openings) must be made with the battery disconnected and regulator preferably off the vehicle.

d. Cleaning Contact Points. Clean contact points with a fine-cut riffler file. The contact file should not be allowed to become greasy and should not be used to file other metals. When cleaning the contact points it should be remembered that tungsten is extremely hard and platinum is relatively soft. Platinum points should be filed very lightly to avoid excessive loss of metal. Never use sandpaper or emery cloth to clean contact points.

e. Regulator Checks and Adjustments (fig. 12-2).

(1) *Cutout Relay*. Three checks and adjustments are required on the cutout relay;

air gap, point opening and closing voltage. Air gap and point opening are checked with the battery disconnected.

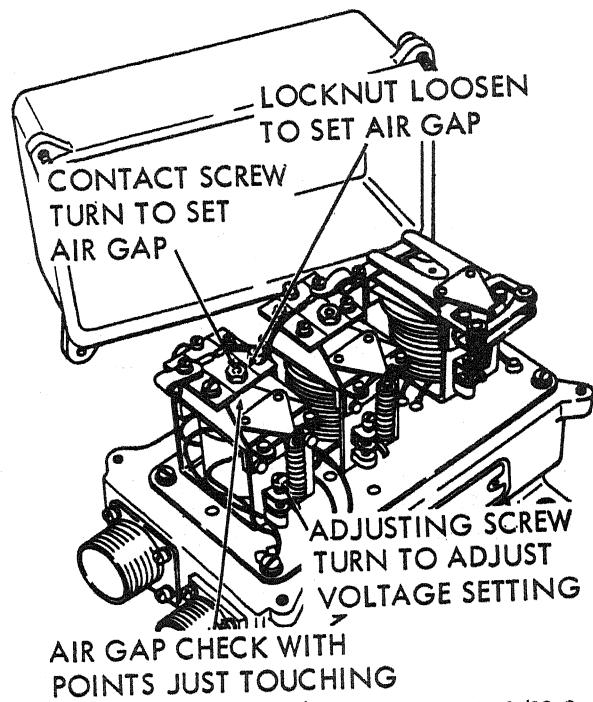
(a) *Air Gap.* Measure the air gap between the armature and the core not between the brass pin in the armature and the core with the contact points barely touching. If both sets of points do not close together, it will be necessary to realign the lower contact bracket slightly or to bend the spring fingers on the armature until points do meet simultaneously. Adjust air gap by loosening the two screws attaching the lower contact bracket, and raise or lower the contact bracket as required. Be sure the points are properly lined up and tighten the screws well after adjustment.

(b) *Point Opening.* Measure the point opening and adjust by bending the upper armature stop.

(c) *Closing Voltage.* To check the closing voltage on the cutout relay, insert Special Testing Harness No. 1 (fig. 12-5) in the generator circuit, and connect a voltmeter between T-1 (armature) and the ground screw at the end of the regulator (fig. 12-4). Gradually increase generator speed and note the voltage at which the relay contact points close. Adjust the closing voltage, if necessary, by turning the adjusting screw at the base of the cutout relay frame. Increasing the spiral spring tension increases the relay closing voltage—decreasing the spiral spring tension lowers the closing voltage.

(2) *Voltage Regulator.* Two checks and adjustments are required on the voltage regulator: air gap and voltage setting. Attention is called to fact that the AIR GAP and not the POINT OPENING is checked and adjusted.

(a) *Air Gap.* The air gap should be measured between the armature and the part of the core (not the residual pin in the core) next to the residual pin, with the points just touching. The proper way to measure this air gap is to push the armature down until the points open, release until the points barely close, then measure the air gap. Do not measure the gap with the flat spring that supports the contact screw raised up off the fiber mount-



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Figure 12-2. Voltage and current regulator adjustments.

ing plate. To adjust, loosen the locknut and turn the contact screw. The most convenient method of performing this operation is to insert the gage, press the armature down against it to hold it in place, and then turn the contact screw until the contacts barely touch.

(b) *Voltage Setting.* (fig. 12-6). Disconnect battery cable from regulator, and connect voltmeter between regulator battery terminal, and ground screws in the end of the regulator. With the generator operating at approximately 3000 RPM and the regulator at operating temperature, note the voltage setting. Adjust by turning the adjusting screw at the base of the unit, thereby changing the spiral spring tension. Increasing the spring tension increases the voltage setting. After each change of adjustment, reduce generator speed until cutout relay opens; then return to speed and read voltage.

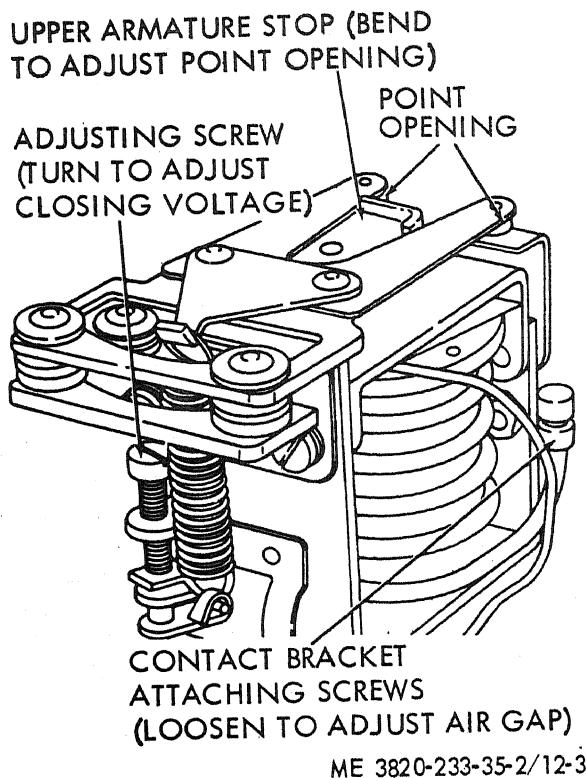


Figure 12-3. Cutout relay adjustments.

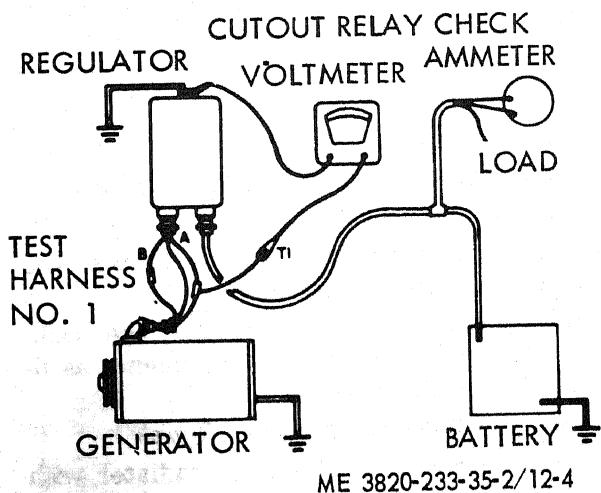


Figure 12-4. Meter connections for checking cutout relay closing voltage.

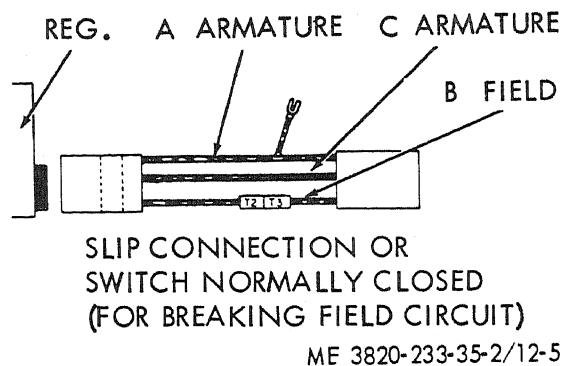


Figure 12-5. Suggested special testing harness No. 1 for electrical checking.

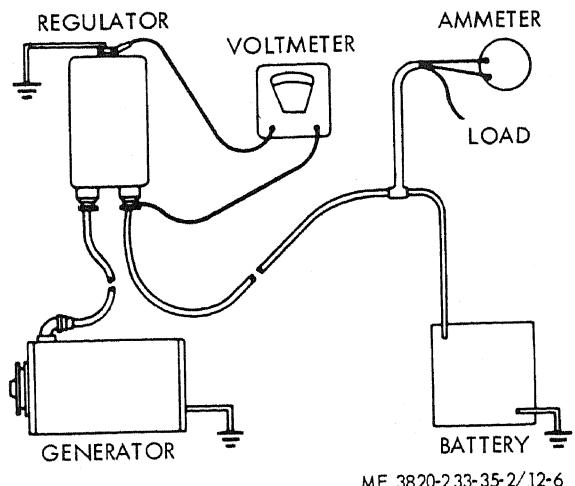


Figure 12-6. Meter connections for voltage regulator checks.

(3) *Current Regulator.* Two checks and adjustments are required on the current regulator: air gap and current setting. The AIR GAP and not the POINT OPENING is checked and adjusted procedure being the same as for the voltage regulator above. Current Setting (fig. 12-7). To check the current regulator setting, it is necessary to keep the voltage regulator from operating so that the generator output can increase to the value for which the current regulator is adjusted, and thus cause the current regulator to operate. Three methods of preventing voltage regulator operation are

available. Regardless of the method used, disconnect battery cable from the regulator and connect an accurate ammeter in series between these junctions. This meter will measure the current regulator setting. The three methods of preventing voltage regulator operation are:

(a) *Battery Discharge Method.* By this method, the battery is partly discharged by cranking the engine for 30 seconds with lights, and other accessories turned on. NEVER USE THE CRANKING MOTOR FOR MORE THAN 30 SECONDS AT A TIME WITHOUT PAUSING TO ALLOW THE CRANKING MOTOR TO COOL OFF. Excessive cranking will damage the cranking motor. Immediately after the cranking cycle, start the engine and allow the generator output to increase to its maximum as determined by the current regulator to operate. Since battery voltage recovers very quickly, this method requires prompt action.

(b) *Load Method.* If a load approximating the current regulator setting is placed across the battery during the time that the current regulator setting test is made, the voltage will not increase sufficiently to cause the voltage regulator to operate. This load may be provided by a carbon pile or other suitable resistance.

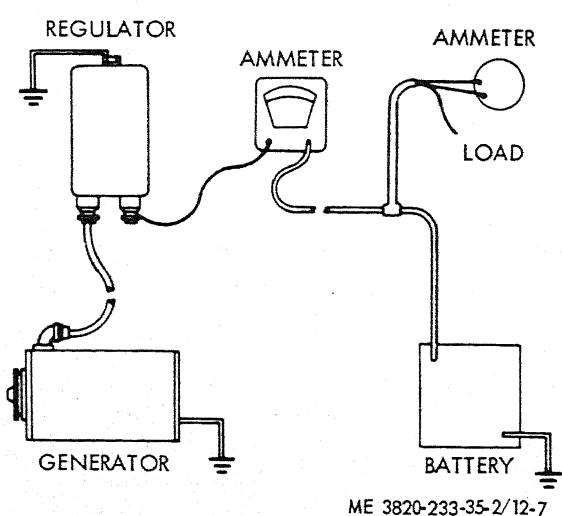


Figure 12-7. Meter connections for current regulator checks.

(c) *Jumper Lead Method.* If the regulator cover is removed and a jumper lead placed across the voltage regulator contact points, the voltage regulator cannot operate. Consequently, the generator output will increase to its maximum as determined by the current regulator setting. Lights and accessories should be turned on during the test to prevent excessive voltage. To adjust the current regulator setting, turn the adjusting screw at the base of the tension. Increasing the tension will increase the current setting. After each change of adjustment, reduce generator speed until cutout relay opens, then return to speed and read current. (Higher residual magnetism resulting from uncontrolled voltage during this test will cause the voltage to regulate at an abnormally low voltage after the jumper is removed. To restore proper operation, the generator must be "cycled", that is, stopped and restarted. Do not attempt to check voltage regulator after using JUMPER LEAD METHOD until this condition has been corrected.)

f. *Installation.* Refer to Operator's Manual.

33. Radiator Assembly

a. *General.* The radiator assembly is mounted on the front of the engine. As the water flows through the radiator core, it is cooled by air forced through the core by a belt driven fan. A guard is attached to the fan shroud to prevent loose clothing, hands, and other objects from becoming entangled in the fan blades.

b. *Removal and Disassembly*

- (1) Remove the power unit (para 23).
- (2) Drain the radiator.
- (3) Remove the hoods, side panels, and tie rods (Operator's Manual).
- (4) Remove and disassemble the radiator assembly in the numerical sequence as illustrated on figure 13.

c. *Cleaning, Inspection, and Repair*

- (1) Flush the inside of the radiator with an approved cleaning solvent.
- (2) Plug the radiator openings. Insert an air hose in radiator outlet pipe. Immerse the radiator in water and apply 3-5 psi. Air

pressure to the radiator. Leaks will be indicated by air bubbles. Solder leads or replace an excessively damaged radiator.

(3) Inspect the radiator assembly for other defects and damage. Replace an excessively damaged radiator core.

d. Reassembly and Installation

(1) Refer to figure 13 and assemble and install the radiator assembly.

(2) Install the hoods, side panels, and tie rods (Operator's Manual).

(3) Fill the radiator with coolant.

(4) Install the power unit (para 23).

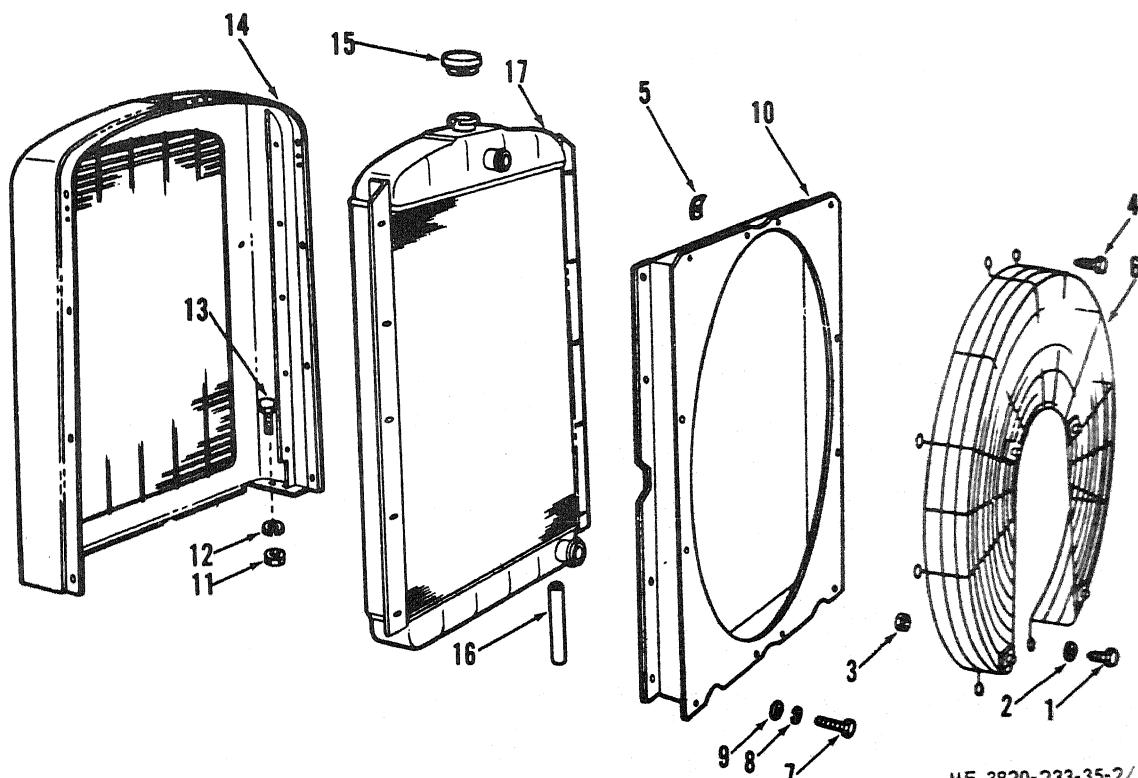
34. Water Pump

a. General. The water pump is mounted on the front end of the blower and is driven by the lower blower rotor shaft. The centrifugal type water pump circulates coolant through the cylinder block, cylinder head, radiator, and oil cooler.

b. Removal. Refer to Operator's Manual.

c. Disassembly. Disassemble the water pump in the numerical sequence as illustrated on figure 14.

Note. It may be necessary to use an arbor press to separate water pump shaft from impeller.



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- 1 Bolt
- 2 Washer
- 3 Nut
- 4 Bolt
- 5 Speednut
- 6 Guard

- 7 Bolt
- 8 Lockwasher
- 9 Washer
- 10 Shroud
- 11 Nut
- 12 Lockwasher

- 13 Bolt
- 14 Shell assembly
- 15 Cap
- 16 Hose
- 17 Radiator

Figure 13. Radiator assembly, exploded view.

d. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent.

Caution: Do not immerse pump shaft assembly in cleaning solvent. Dirt may be washed into sealed shaft bearing and cannot be entirely removed.

(2) Inspect pump body, pump shaft, seals and impeller for cracks, scoring, wear, or other damage. Replace defective parts as necessary.

(3) Inspect studs in pump body. Replace studs if necessary, and torque to 10-12 foot pounds.

e. Reassembly. Reassemble the water pump in the reverse numerical sequence as illustrated on figure 14.

(1) If steel insert is replaced, be sure the counterbore in pump body is thoroughly cleaned before installing new insert. Press in-

sert in until it contacts the shoulder in pump body.

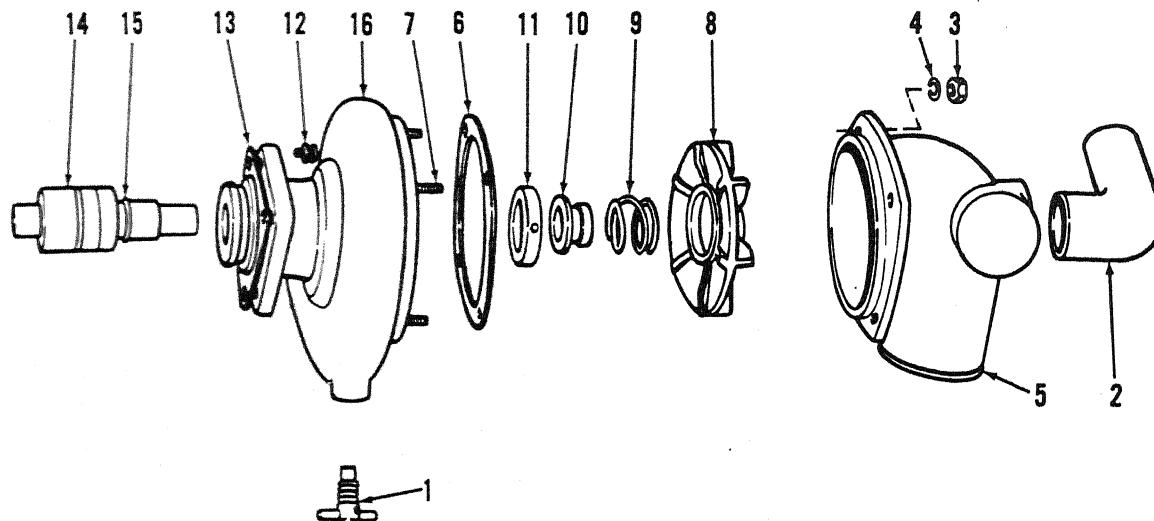
Note. Do not mar the seal contact surface of the insert when pressing it into the pump body.

(2) Install slinger on the pump shaft assembly with the flange of the slinger approximately 3/16 inch from end of the outer race of the shaft assembly bearing.

(3) Place impeller end of pump body on an arbor press, and insert slinger end of pump shaft into pump body. Press against the outer race of pump shaft bearing until bearing touches the shoulder in the pump body.

(4) Clean surface of pump seal, and apply a thin coat of liquid soap on inside surface of seal. Slide seal onto pump shaft until it is seated firmly against the pump body insert.

(5) Install pump seal spring with the small end toward the seal.



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1 Draincock	7 Stud	13 Gasket
2 Connector	8 Impeller	14 Shaft assembly
3 Nut	9 Spring	15 Slinger
4 Lockwasher	10 Seal	16 Body assembly
5 Cover	11 Insert	
6 Gasket	12 Bolt (with seal washer)	

Figure 14. Water pump, exploded view.

(6) Support bearing end of pump shaft on an arbor press and press impeller onto the shaft. Press until face of impeller hub is flush with the end of the pump shaft.

(7) Rotate pump shaft by hand to be sure impeller does not contact pump body.

(8) Install new pump cover gasket. Slide the pump cover over studs and secure the pump body with four lockwashers and nuts.

(9) Install drain cock.

f. Installation. Refer to Operator's Manual.

35. Hydraulic Governor and Governor Drive

a. General

(1) The hydraulic governor regulates the engine speed under varying load conditions, and serves as an automatic shutdown device when there is a malfunction in the lubricating oil pressure system. Should the engine fail to supply oil to the governor, the servo motor piston will drop, allowing the fuel rod to return to the NO FUEL position.

(2) The governor is driven by the upper blower rotor through a horizontal drive shaft and bevel gear, and a vertical driven shaft and bevel gear. Both are mounted on ball bearings and located in the governor drive housing.

b. Removal. Refer to Operator's Manual.

c. Disassembly. Disassemble the governor and governor drive assembly in the numerical sequence as illustrated on figure 15.

d. Cleaning, Inspection, and Repair

(1) Wash all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect pilot valve plunger for scratches or burrs. Defective areas may be corrected with a fine India stone.

Note. Do not round off edges of plunger when dressing it with the India stone.

(3) Inspect servo motor piston for scratches or burrs. Correct defective areas with a fine India stone.

Note. Do not round off edges of piston when dressing it with the India stone.

(4) Inspect oil pump gears and gear teeth of drive and driven shafts for scoring, chipping or wear. Replace defective parts.

(5) Inspect drive and driven shafts for scoring and wear. Replace a defective shaft.

(6) Inspect all bushings and bearings for distortion, wear, pits, scoring, or wear. Replace defective bushings and bearings.

e. Reassembly

(1) Reassemble the governor and governor assembly in the reverse of the numerical sequence as illustrated on figure 15.

(2) When reassembling bearing (15) and drive shaft (16), support bearing on the bed of an arbor press, and press drive shaft into bearing until shoulder of shaft is against the bearing.

(3) To reassemble bearing (77), sleeve (76), and driven shaft (78), start bearing on shaft followed by the sleeve. Properly support sleeve on the bed of an arbor press, and press shaft into bearing and sleeve.

f. Installation and Adjustment. Refer to the Operator's Manual.

36. Fuel Pump

a. General. The fuel pump is mounted on the rear of the blower assembly and is driven by the lower blower rotor. The fuel pump draws fuel from the supply tank and delivers it at correct pressure to the fuel injectors.

b. Removal. Refer to the Operator's Manual.

c. Disassembly. Disassemble the fuel pump in the numerical sequence as illustrated on figure 16.

Note. Use extreme care when removing drive shaft as score marks on the square end of shaft will damage the oil seal contact surface.

d. Cleaning, Inspection, and Repair

(1) Clean all of the parts with an approved cleaning solvent and dry them thoroughly.

(2) Inspect oil seals for nicks and cracks. If oil seals are removed, they must be discarded and replaced with new seals.

(3) Inspect pump shafts and gears for wear or scoring. The driven shaft is serviced as a gear and shaft assembly only. Replace defective parts.

(4) Inspect pump body and cover for scoring or other damage. Replace defective or damaged pump body or cover.

(5) Inspect relief valve for scoring and burrs. If valve is scored and cannot be cleaned up with fine emery cloth or crocus cloth, replace the valve.

(6) Inspect drive coupling fork for wear or other damage. Replace defective coupling.

(7) Test valve retaining spring. Apply a load of 7.1 pounds to 7.5 pounds to the spring. The spring should compress to a length

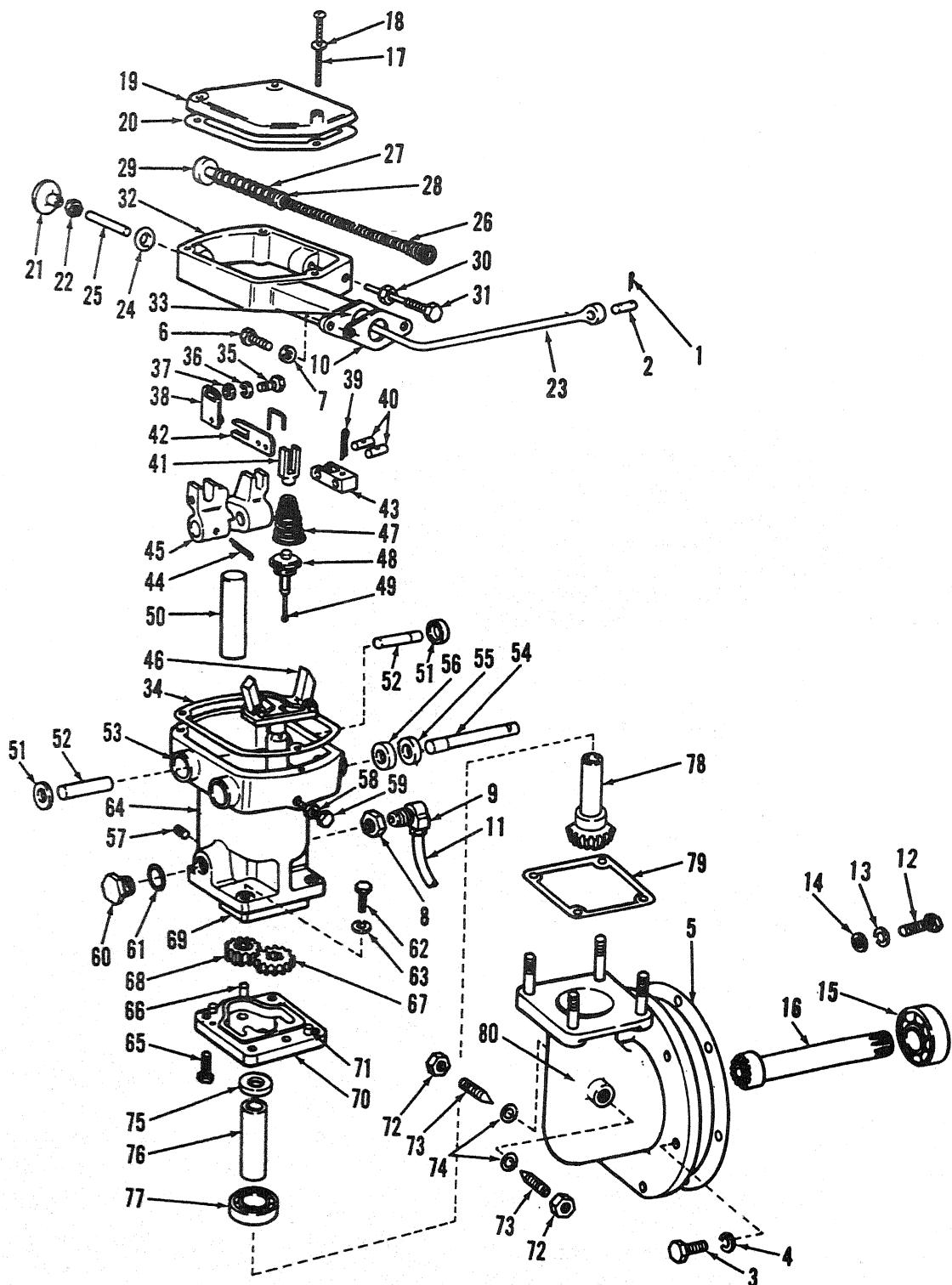


Figure 15. Hydraulic governor, exploded view.

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1	Cotter pin	28	Disc	55	Seal
2	Link	29	Collar	56	Seal
3	Bolt	30	Nut	57	Plug
4	Washer	31	Screw	58	Nut
5	Gasket	32	Sub cap	59	Screw
6	Bolt	33	Plug	60	Plug
7	Lockwasher	34	Gasket	61	Gasket
8	Nut	35	Bolt	62	Bolt
9	Elbow	36	Lockwasher	63	Lockwasher
10	Gasket	37	Washer	64	Housing assembly
11	Tube	38	Bracket	65	Bolt
12	Bolt	39	Pin	66	Stud
13	Lockwasher	40	Pin	67	Gear
14	Washer	41	Fork	68	Gear
15	Bearing	42	Lever	69	Ring
16	Shaft	43	Lever	70	Base
17	Screw	44	Pin	71	Pin
18	Washer	45	Lever	72	Nut
19	Cover	46	Ball head assembly	73	Setscrew
20	Gasket	47	Spring	74	Gasket
21	Knob	48	Bearing	75	Ring
22	Nut	49	Plunger	76	Sleeve
23	Rod (R.H.)	50	Piston	77	Bearing
24	Seal	51	Plug	78	Shaft
25	Spacer	52	Shaft	79	Gasket
26	Spring	53	Bushing	80	Housing
27	Spring	54	Shaft		

Figure 15—Continued

of 1.18 inch. If the spring fails to meet this specification, replace the valve retaining spring.

e. Reassembly. Reassemble the fuel pump in the reverse of the numerical sequence as illustrated on figure 16.

Note. Install fuel pump drive gear over the end of the drive shaft which is not squared to prevent scoring the square end of the shaft.

Note. Apply only a thin coat of approved sealant on the face of the pump cover outside of the gear pocket area. Too much sealant could increase the clearances and affect pump efficiency. Do not apply sealant into the gear pocket, or damage to the gears and shafts will result.

f. Installation. Refer to the Operator's Manual.

37. Blower and Blower Drive Assembly

a. General. The blower supplies the fresh air needed for combustion and removing exhaust gases from the cylinders. The blower spiral rotors provide continuous and uniform air flow.

b. Removal

(1) Drain the cooling system (Operator's Manual).

(2) Remove the oil lines (Operator's Manual).

(3) Remove the fuel filter lines (Operator's Manual).

(4) Remove the fuel pump (Operator's Manual).

(5) Remove the water pump (Operator's Manual).

(6) Remove the hydraulic governor (Operator's Manual).

(7) Remove the air inlet housing blower, and blower drive assembly in the numerical sequence as illustrated on figure 17-1.

c. Disassembly

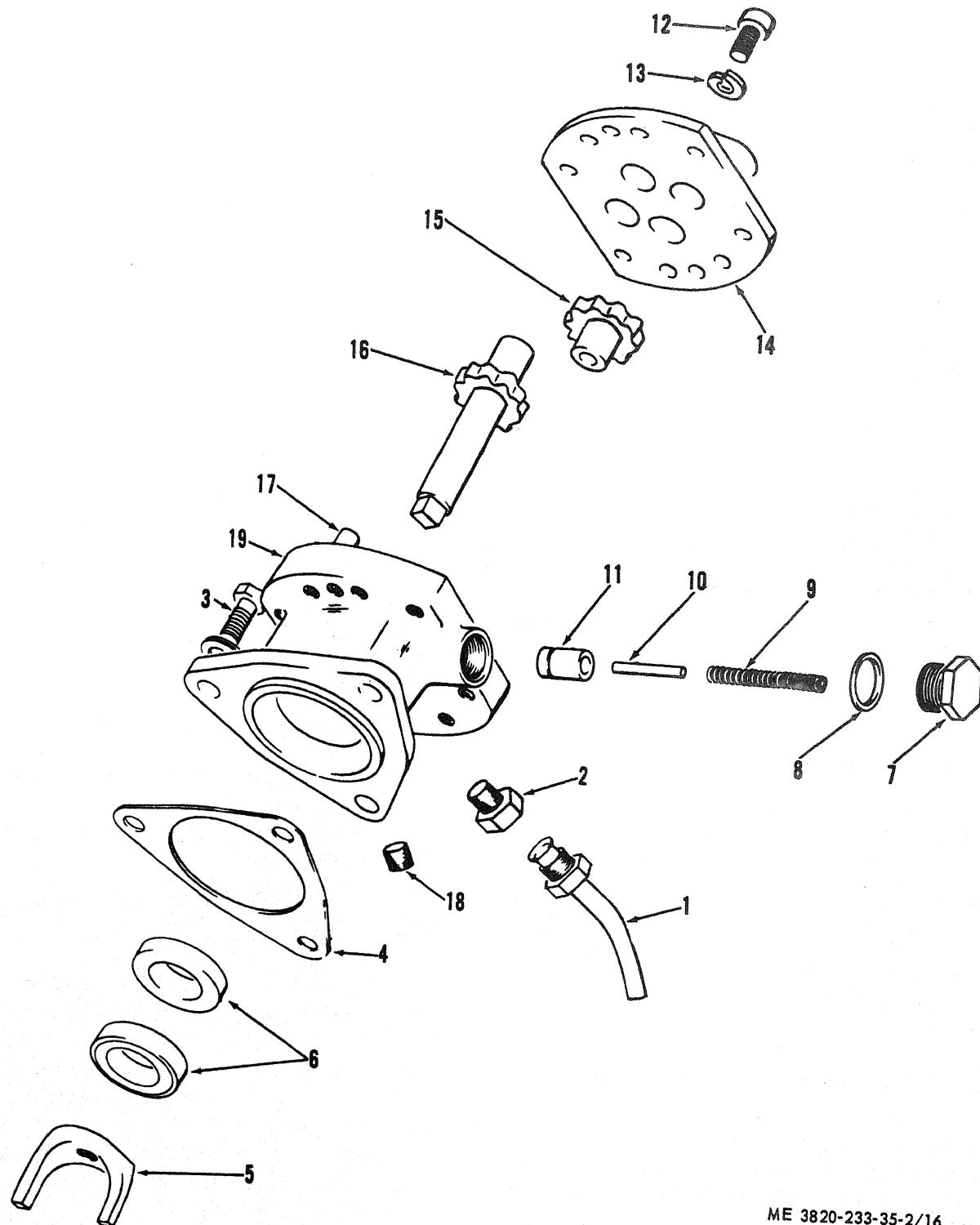
(1) Disassemble the air inlet housing in the numerical sequence as illustrated on figure 17-2.

(2) Disassemble the blower and blower drive assembly in the numerical sequence as illustrated on figures 17-3 and 17-4.

d. Cleaning, Inspection, and Repair.

(1) Clean all of the blower parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect bearings for corrosion or pitting. Replace defective bearings.

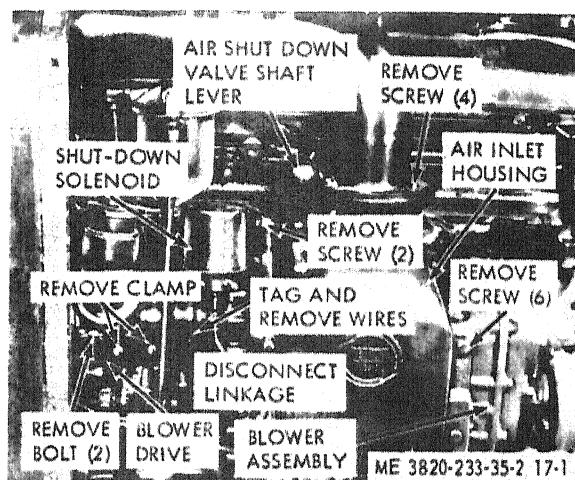


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Figure 16. Fuel pump, exploded view.

1	Tube assembly	8	Gasket	15	Shaft assembly
2	Connector	9	Spring	16	Shaft assembly
3	Bolt	10	Pin	17	Pin
4	Gasket	11	Valve	18	Plug
5	Fork	12	Bolt	19	Body
6	Seal	13	Lockwasher		
7	Plug	14	Cover		

Figure 16—Continued



STEP 1. REMOVE SHUT-DOWN SOLENOID
 STEP 2. DISCONNECT SHUT-DOWN WIRE (NOT SHOWN) FROM AIR SHUT-DOWN VALVE SHAFT LEVER
 STEP 3. REMOVE AIR INLET HOUSING
 STEP 4. REMOVE BLOWER DRIVE.
 STEP 5. REMOVE BLOWER ASSEMBLY

Figure 17-1. Air inlet housing, blower and blower drive assembly, removal and installation.

(3) Inspect the blower rotor lobes for burrs and scoring. If rotors are only slightly scored or burred, clean them with emery cloth. Replace excessively scored or burred rotors.

(4) Inspect rotor shaft serrations for wear burrs, or peening. Replace defective rotor.

(5) Inspect the inside surfaces of the blower housing for burrs or scoring. Clean up slightly scored or burred areas with emery cloth.

(6) Inspect inside face of each end plate. If the finished face is slightly scored or burred, clean with emery cloth.

(7) Inspect the serrations in the blower timing gears for wear and peening. Inspect

gear teeth for wear, chipping, or other damage. Back lash between gear teeth should not exceed 0.004 inch. Replace defective or damaged timing gears as a set.

(8) Inspect blower drive shaft serrations for wear or other damage. Replace a damaged or bent shaft.

(9) Inspect the serrations inside the rotor drive hub for wear or other damage. Replace a defective drive hub.

(10) Inspect the blower drive coupling springs and cam for wear and other damage. Replace defective parts.

(11) Inspect the thrust washers. Replace worn or scored washers.

(12) Inspect bearings for binding, wear, or scoring. Replace a defective bearing.

(13) Inspect the blower drive coupling support, cam spring seats, and spring packs for wear or other damage. Replace any defective parts.

(14) Inspect blower drive gear teeth for chipping, wear, or scoring. Replace a defective gear.

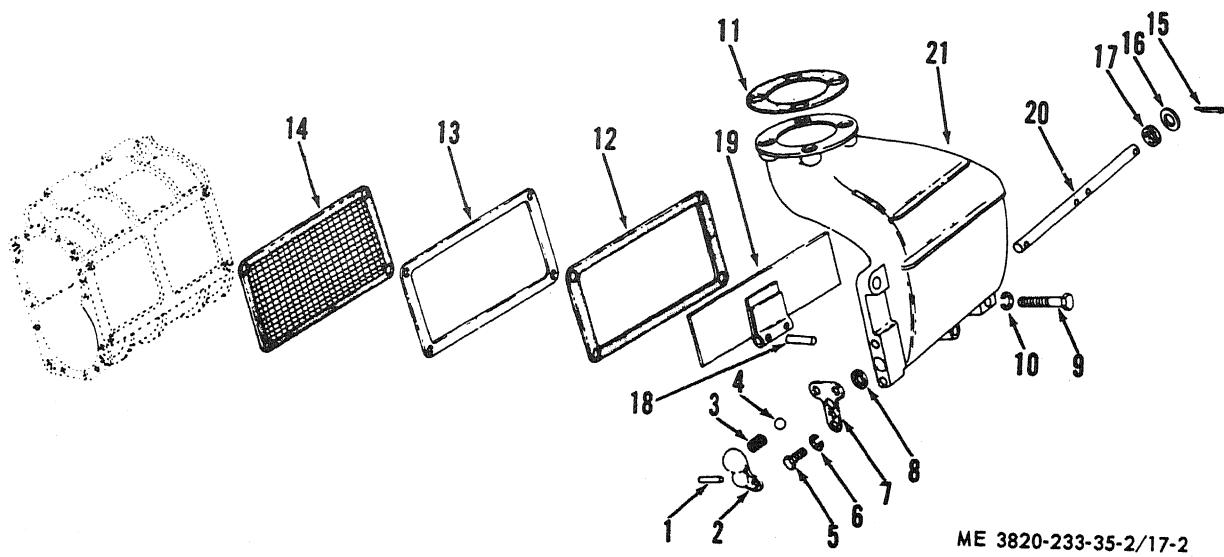
(15) Replace worn or excessively damaged air inlet housing, blower, and blower drive parts.

e. Reassembly

(1) Reassemble the blower assembly in the reverse of the numerical sequence as illustrated on figure 17-4.

(a) Press oil seal (44) into the end plate (87). Position the oil seal approximately .005 inch below the finished face of the end plate. Install the remaining oil seals in the end plates in the same manner.

(b) The dowel pins located on end plates (31 and 46), must project .380 inch from the flat inner face and .270 inch from the outer face of the end plates.



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1	Pin
2	Lever
3	Spring
4	Ball
5	Bolt
6	Lockwasher
7	Lockplate
8	Ring
9	Bolt
10	Lockwasher
11	Gasket
12	Gasket
13	Plate
14	Screen

15	Pin
16	Washer
17	Seal
18	Pin
19	Valve
20	Shaft
21	Housing

Figure 17-2. Air inlet housing, exploded view.

(c) Torque bearing retainer bolts (26 and 41) to 7-9 lb.-ft.

(d) Torque water pump drive coupling retaining bolt (39) to 18 lb.-ft.

(e) Torque end plate cover (37) mounting bolts (35) to 13-17 lb.-ft.

(f) Before installing the blower rotor timing gears (24), check rotor-to-end plate and rotor-to-housing clearances. See figure 17-5.

(g) Torque rotor timing gear retaining bolts (20) to 55-65 lb.-ft.

(h) After the blower rotors (33 and 34) and timing gears (24) are installed, time the blower rotors as shown on figure 17-5.

Note. When the right hand helix gear is moved out, the right hand helix rotor will turn counterclockwise when viewed from the gear end. When the left hand helix gear is moved out, the left hand helix rotor will turn clockwise when viewed from the gear end.

(i) If more or less shims are required to produce the desired clearance indicated on figure 17-5, both gears must be removed from the rotors.

Note. Installing a .003 inch shim in back of a rotor gear will turn the rotor .001 inch.

(j) Determine the minimum clearances at points "A" and "B" shown on figure 17-5. Measure clearances at the ends of each lobe, making 12 measurements in all.

(k) Refer to figure 17-5 and measure the clearance between each rotor lobe and the blower housing at both the inlet and outlet side. Twelve measurements are required.

(l) Torque the plate to hub bolts (14) to 25-30 ft. lb.

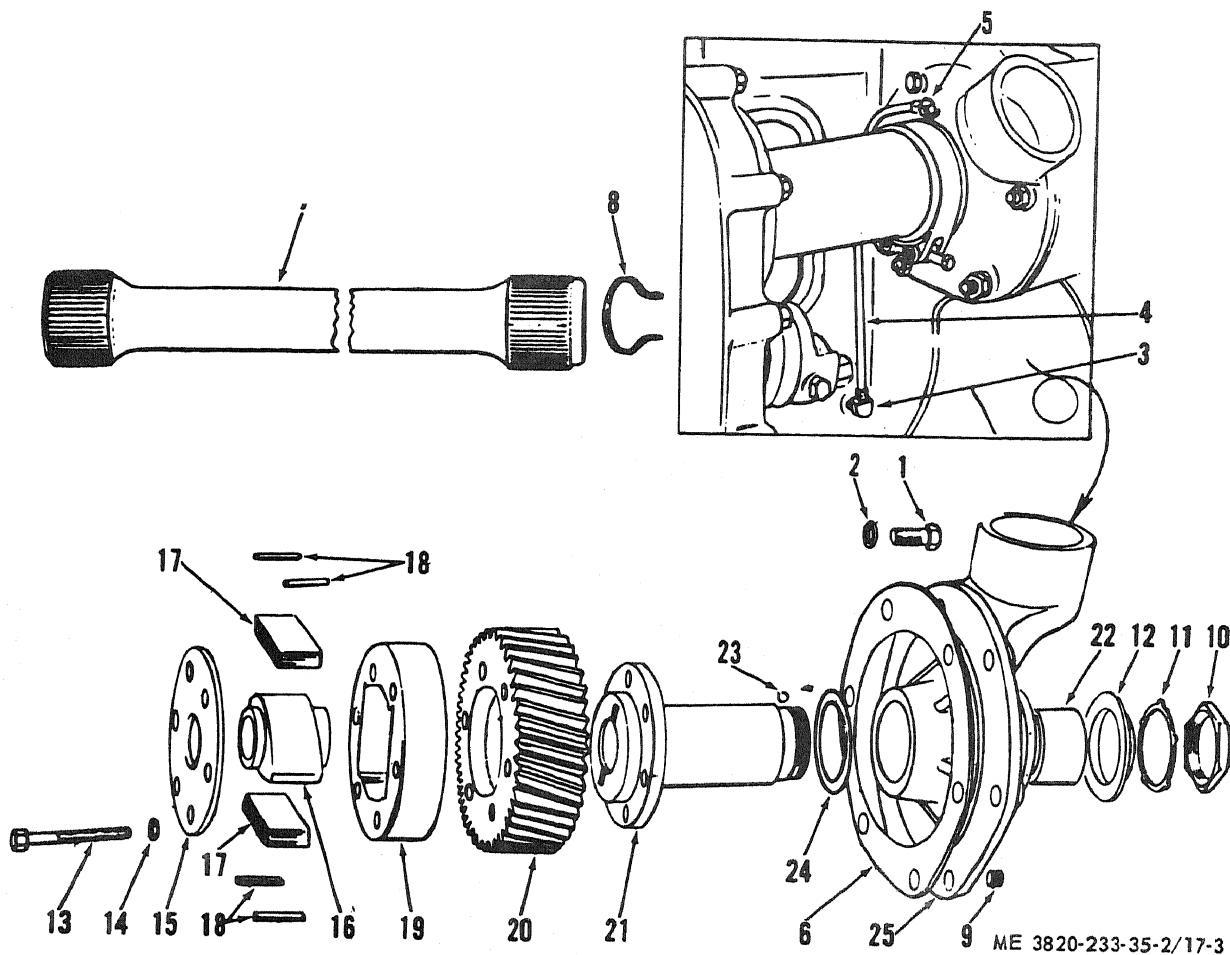
(m) Torque plate to gear bolts (11) to 25-30 ft. lb.

(n) Measure the runout of the rotor drive hub splines with an indicator. The spline runout must not exceed .020 inch total indicator reading.

(o) Torque end plate cover (7) mounting bolts to 13-17 ft. lb.

(2) Reassemble the blower drive assembly in the reverse of the numerical sequence as illustrated on figure 17-3.

Note. Torque the hub nut (10) to 50-60 ft-lb.



1	Bolt	10	Nut	19	Support
2	Lockwasher	11	Lockwasher	20	Gear
3	Tee	12	Washer	21	Hub
4	Pipe	13	Bolt	22	Bearing
5	Elbow	14	Lockwasher	23	Ball
6	Gasket	15	Retainer	24	Washer
7	Shaft	16	Cam	25	Support
8	Ring	17	Spring		
9	Plug	18	Seat		

Figure 17-3. Blower drive, exploded view.

(3) Reassemble the air inlet housing in the reverse of the numerical sequence as illustrated on figure 17-2.

f. Installation.

(1) Install the air inlet housing, blower, and blower drive assembly in the reverse of the numerical sequence as illustrated on figure 17-1.

(2) Torque the blower to cylinder block bolts to 55-60—ft. lb.

(3) Torque air inlet housing mounting bolts to 16-20—ft. lb.

(4) Reverse steps 1 through 6 under "Blower and Blower Drive Assembly Removal."

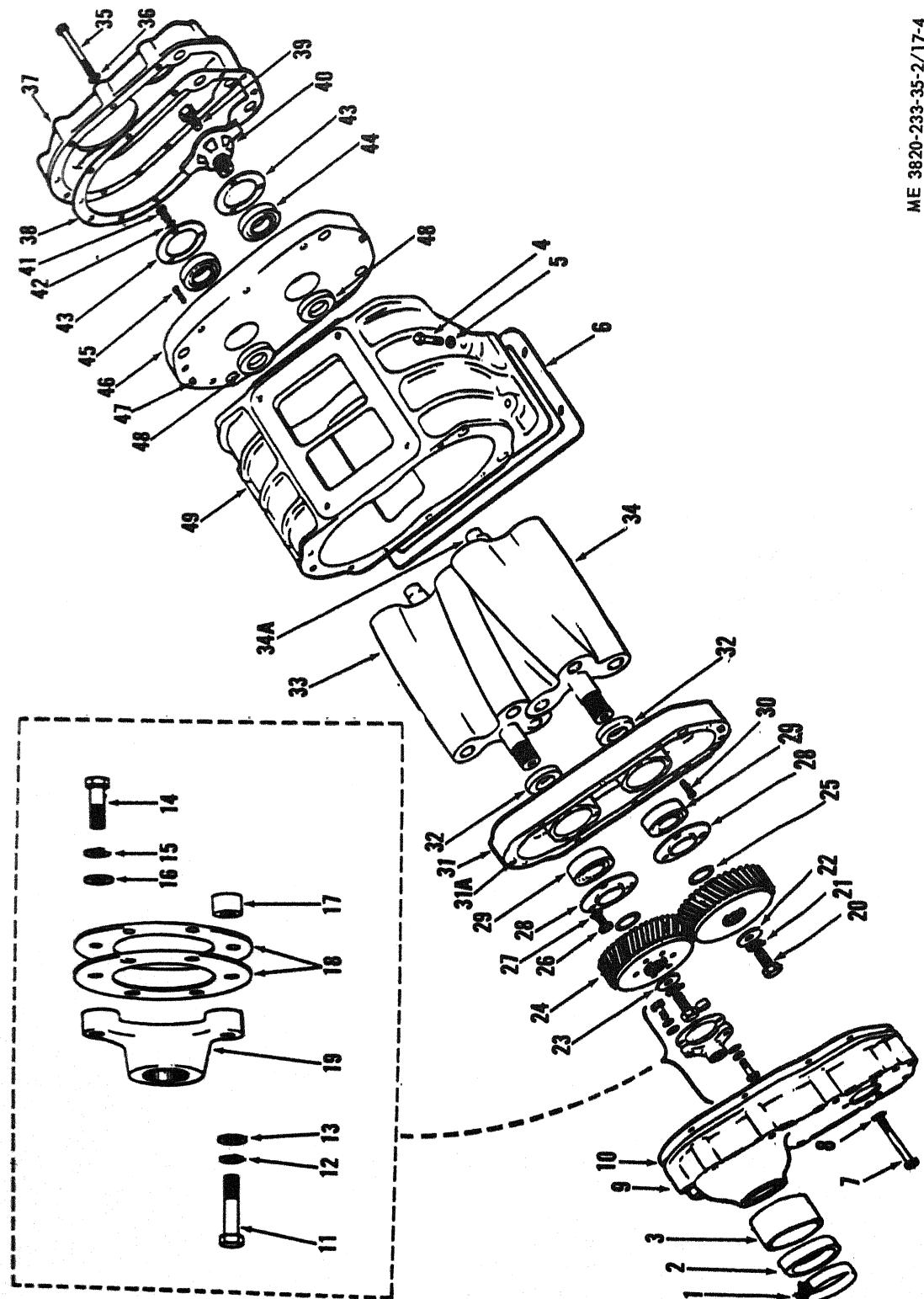
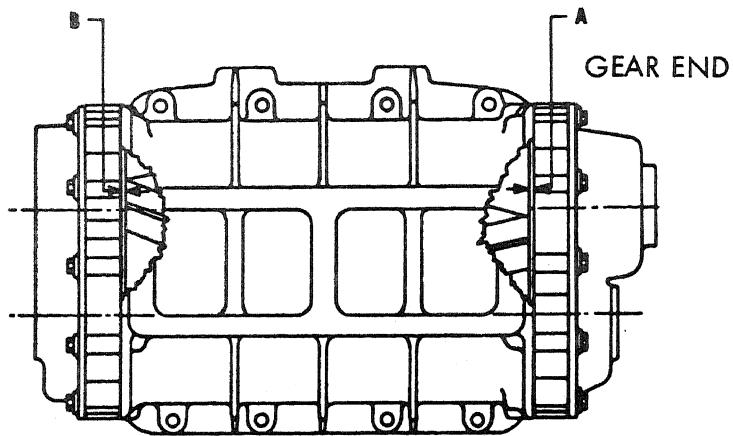


Figure 17-4. Blower, exploded view.

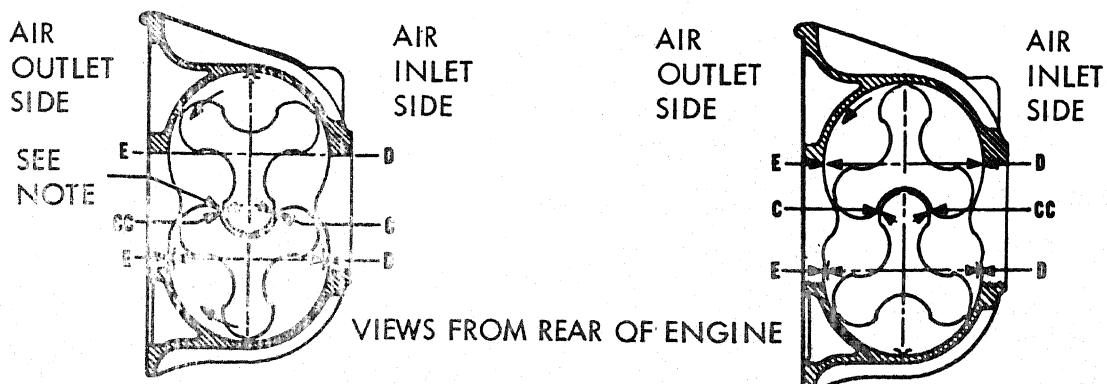
1	Clamp	14	Bolt	27	Lockwasher
2	Seal	15	Lockwasher	28	Retainer
3	Cover	16	Washer	29	Bearing
4	Bolt	17	Spacer	30	Screw
5	Washer	18	Plate	31	Plate
6	Gasket	19	Hub	31A	Pin
7	Bolt	20	Bolt	32	Seal
8	Lockwasher	21	Lockwasher	33	Rotor
9	Cover	22	Disc	34	Rotor
10	Gasket	23	Disc	34A	Shaft
11	Bolt	24	Gear set	35	Bolt
12	Lockwasher	25	Shim	36	Lockwasher
13	Washer	26	Bolt	37	Cover
					38 Gasket
					39 Bolt
					40 Coupling
					41 Bolt
					42 Lockwasher
					43 Retainer
					44 Bearing
					45 Screw
					46 Plate
					47 Pin
					48 Seal
					49 Housing

Figure 17-4—Continued.



	A	B	C	CC	D	E
MIN.	.007	.009	.014	.002	.015	.004
MAX.				.006		

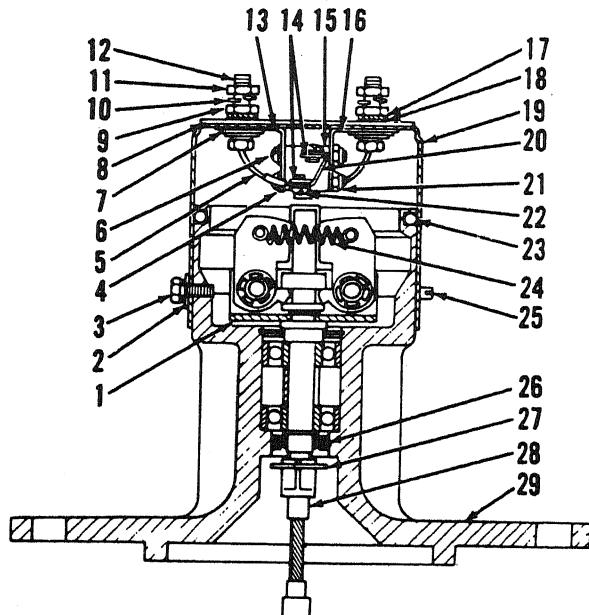
TIME ROTORS TO DIMENSIONS ABOVE



NOTE: TIME ROTORS TO DIMENSION ON CHART FOR
CLEARANCE BETWEEN TRAILING SIDE OF UPPER
ROTOR AND LEADING SIDE OF LOWER ROTOR (CC)
FROM BOTH OUTLET AND INLET SIDE OF BLOWER

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Figure 17-5. Timing blower rotors.



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1	Rotor assembly	16	Bracket (R.H.)
2	Washer	17	Washer
3	Screw	18	Bushing
4	Lockwasher	19	Cap
5	Wire assembly	20	Lug
6	Screw	21	Nut
7	Washer	22	Screw
8	Washer	23	Packing
9	Nut	24	Spring
10	Lockwasher	25	Stud
11	Nut	26	Seal
12	Screw	27	Ring
13	Bracket (L.H.)	28	Shaft
14	Lockwasher	29	Housing
15	Switch		

Figure 18. Overspeed governor, disassembly and reassembly.

Section II. ENGINE COMPONENTS

39. General

The engine is a four cylinder, two cycle, diesel with overhead valves. The engine components are fully described in the applicable paragraphs throughout this section.

40. Exhaust Manifold

a. *General.* The air cooled exhaust manifold is mounted on the cylinder head.

b. *Removal*

(1) Disconnect the muffler from the exhaust manifold.

(2) Refer to figure 19 and remove the exhaust manifold.

c. Cleaning and Inspection

(1) Remove loose carbon deposits and other foreign material from the internal walls of the exhaust manifold.

(2) Inspect exhaust manifold studs for damage. If stud threads are stripped, replace the studs. Torque new studs to 25—40 foot pounds.

d. Installation. Refer to figure 19 and install the exhaust manifold.

(1) Install new exhaust flange and exhaust manifold gaskets.

(2) Torque manifold attaching nuts to 30—35 foot pounds.

(3) Refer to the Operator's Manual and install the muffler. Torque exhaust manifold outlet flange nuts to 20—25 foot pounds.

41. Fuel Injector

a. General. A fuel injector assembly is located in each of the four cylinders. The fuel injector creates the high fuel pressure required for efficient injection, meters and injects the exact amount of fuel required to handle the load on the engine, atomizes the fuel for mixing with the air in the combustion chamber, and permits continuous fuel flow.

b. Removal. Refer to the Operator's Manual.

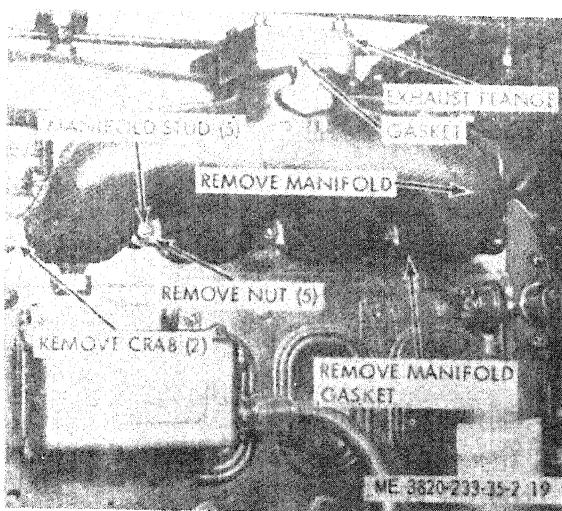


Figure 19. Exhaust manifold, removal and installation.

c. Bench Testing

(1) Test the spray tip runout with a dial indicator. Total runout must not exceed 0.008 inch. If the runout exceeds 0.0008 inch, loosen retaining nut and recenter nozzle tip in the nut. Tighten nut and recheck runout. Repeat the procedure until correct runout is obtained.

(2) Hold the injector assembly in a horizontal position with the coupling end of the control rack pointing upward. Quickly invert the injector assembly so the coupling end points downward. The rack should move freely through its full travel by its own weight. To correct improper rack travel, loosen the retaining nut, rotate the tip assembly, tighten nut, and recheck rack travel. Repeat procedure until proper freedom of travel is attained.

(3) Install the injector assembly in a holding device with the top side up. Position the control rack in the full fuel position, no fuel position, and midway between. Depress the follower with the rack in each position. To correct the lack of free return, disassemble and reassemble the injector assembly and recheck the follower return. Replace if necessary.

(4) Install the injector assembly in the injector test fixture. Position the control rack in the full fuel position and check each nozzle tip orifice for equal fuel discharge pressure. The pressure should be from 450 to 850 psi. Valve opening pressure below 450 psi indicates a defective spring. Replace a defective spring or the injector assembly.

(5) Dry the injector assembly with a clean lint-free cloth. Establish pressure on the injector just below the injector opening pressure and close the pump valve. Check the time required for the pressure to drop from 450 to 250 psi. This time should not be less than 40 seconds. If time is less than minimum stated above, inspect the injector assembly for moist areas and determine source of leaks. Leakage around the seal indicates a loose retaining nut. Leakage at the rack opening in the injector

d. Disassembly. Disassemble fuel injector assembly in the numerical sequence as illustrated in figure 20.

e. Cleaning, Inspection, and Repair

(1) Clean the fuel injector parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect teeth on the control rack and the control rack gear for wear or other damage. Replace a defective control rack or control rack gear.

(3) Test the follower spring compression. When a 48 pound load is applied, the spring should compress to a length of 1.028 inch. Replace a defective or worn follower spring.

(4) Inspect all injector parts for wear and damage.

(5) Inspect the seating surfaces of the injector body, bushing, valve seat, injector valve, valve spring, stop valve, valve cage, check valve, and spray tip with a magnifying glass. If any imperfections are observed, lap the sealing surfaces using 600 grit dry lapping powder.

(6) Before reassembling used valve parts in the injector, lap all of the seating surfaces indicated in step 5 above.

(7) Clean all lapped parts with an approved cleaning solvent and dry thoroughly.

f. *Reassembly*. Reassemble the fuel injector in the reverse of the numerical sequence as illustrated on figure 20.

g. *Installation and Timing*. Refer to the Operator's Manual.

42. Rocker Arms and Shaft

a. *General*. The rocker arm assemblies actuate the valves and fuel injectors. The two outer rocker arms operate the exhaust valves and the center rocker arm operates the fuel injectors. The rocker arms are operated by the camshaft through push rods and cam followers.

b. Removal

(1) Refer to the Operator's Manual and remove the rocker arm cover, injector fuel lines, and fuel connectors.

(2) Refer to figure 21-1 and remove the rocker arms and shaft.

c. *Disassembly*. Disassemble the rocker arms and shaft assembly in the numerical sequence as illustrated on figure 21-2.

d. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the rocker arms for cracks, breaks, and other damage. Examine the bushing surfaces of the rocker arms for excessive

wear and scoring. Replace damaged or defective rocker arms.

(3) Inspect the rocker arms for wear, scoring, and ridges from the action of rocker arms on the shaft. Replace a damaged or defective rocker arm shaft.

(4) Inspect push rods for warpage, cracks, breaks, and other damage. Replace damaged or defective push rods.

(5) Inspect rocker arm shaft brackets and rocker arm bushings for cracks, breaks, wear, and other damage. Replace damaged or defective parts.

e. *Reassembly*. Reassemble the rocker arms and shaft assembly in the reverse of the numerical sequence as illustrated on figure 21-2.

f. Installation

(1) Refer to figure 21-1 and install the rocker arms and shaft assembly.

(2) Refer to the Operator's Manual and install the injector fuel lines, fuel connectors, and rocker arm cover.

(3) Refer to the Operator's Manual, and adjust the exhaust valves and injectors.

43. Cylinder Head and Valves

a. *General*. The cylinder head is a one piece casting which can be removed from the engine as an assembly. Located in the cylinder head are the cam followers and guides, push rods, rocker arms, exhaust valves and injectors. The cylinder head is secured to the top of the engine block by studs and bolts.

b. Removal

(1) Drain the cooling system (Operator's Manual).

(2) Remove the muffler and air cleaner (Operator's Manual).

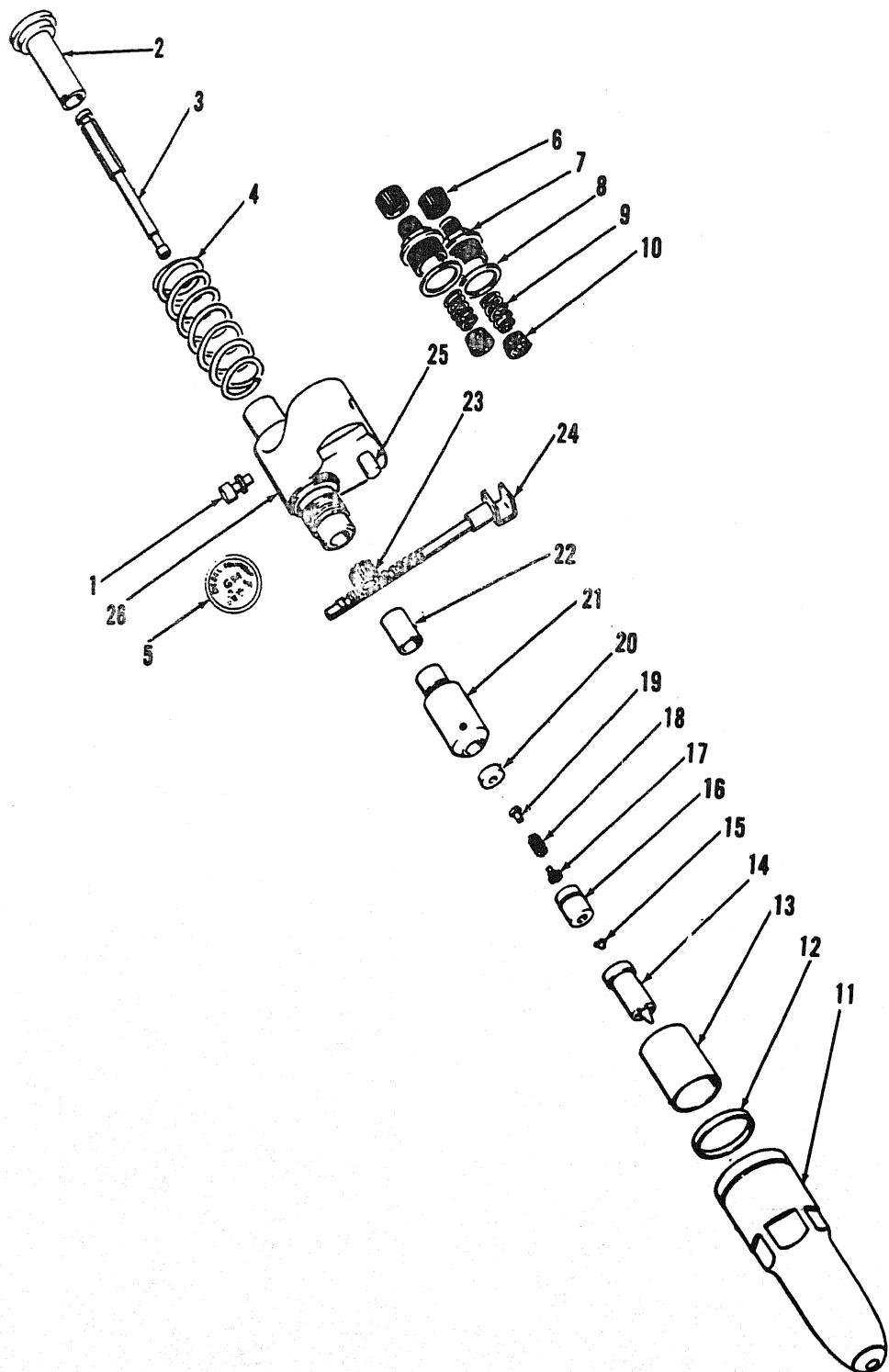
(3) Remove the hoods, side panels, and tie rods (Operator's Manual).

(4) Remove the rocker arm cover (Operator's Manual).

(5) Remove the exhaust manifold (para 40).

(6) Disconnect the throttle control rods at the governor (Operator's Manual).

(7) Remove the water manifold, thermostat housing, and bypass tube (Operator's Manual).

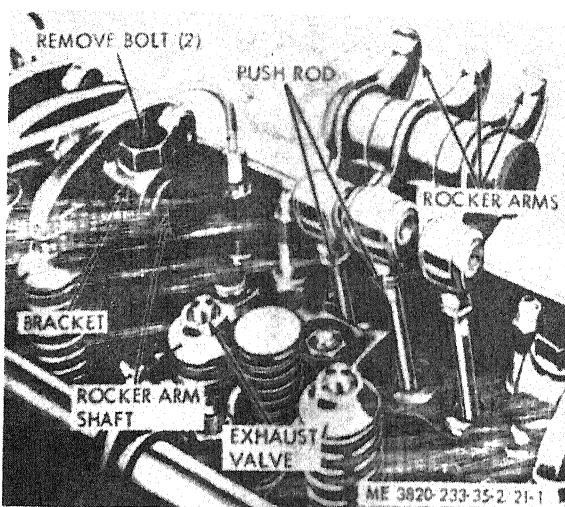


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Figure 20. Fuel injector, exploded view.

1	Pin	10	Element	19	Valve
2	Follower	11	Nut	20	Seat
3	Plunger	12	Ring	21	Plunger and bushing assembly
4	Spring	13	Deflector	22	Retainer
5	Tag	14	Tip	23	Gear
6	Cap	15	Valve	24	Rack
7	Cap	16	Cage	25	Dowel
8	Gasket	17	Stop	26	Body
9	Spring	18	Spring		

Figure 20—Continued



STEP 1. FOLD BACK ROCKER ARMS.
 STEP 2. REMOVE ROCKER ARM SHAFT AND BRACKETS.
 STEP 3. DISCONNECT PUSH ROD FROM ROCKER ARMS.
 STEP 4. REMOVE ROCKER ARMS

Figure 21-1. Rocker arms and shaft, removal and installation.

(8) Remove the fuel oil filter (Operator's Manual).

(9) Disconnect the governor fuel rod from the injector control tube lever. Remove the governor subcap and fuel rod (Operator's Manual).

(10) Remove the fuel injectors and injector control tube (Operator's Manual).

(11) Remove the instrument panel and throttle control rods (Operator's Manual).

(12) Refer to figure 22-1 and remove the cylinder head.

c. Disassembly

(1) Remove the rocker arms and shafts (para 40).

(2) Disassemble the cylinder head in the numerical sequence as illustrated in figure 22-2.

d. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the cylinder head for cracks or damage. Replace a cracked or damaged cylinder head.

(3) Check the bottom of the cylinder head for warpage. The warpage limits are as follows:

Maximum Longitudinal Warpage.	0.008 inch
-------------------------------	------------

Maximum Transverse Warpage.	0.004 inch
-----------------------------	------------

Replace the cylinder head if warpage is beyond the limits specified.

(4) Check the clearance between the valves and valve guides. Replace the guides if the clearance exceeds 0.006 inch.

(5) Inspect valve seats and injector tubes for signs of over heating, looseness, excessive wear or other damage. Replace defective parts.

(6) Inspect the valves for cupped, pitted, burned or worn conditions. Grind the valves and reseat the inserts to an angle of 30 degrees. Replace parts as necessary.

(7) Inspect the valve springs for excessive wear and replace as necessary.

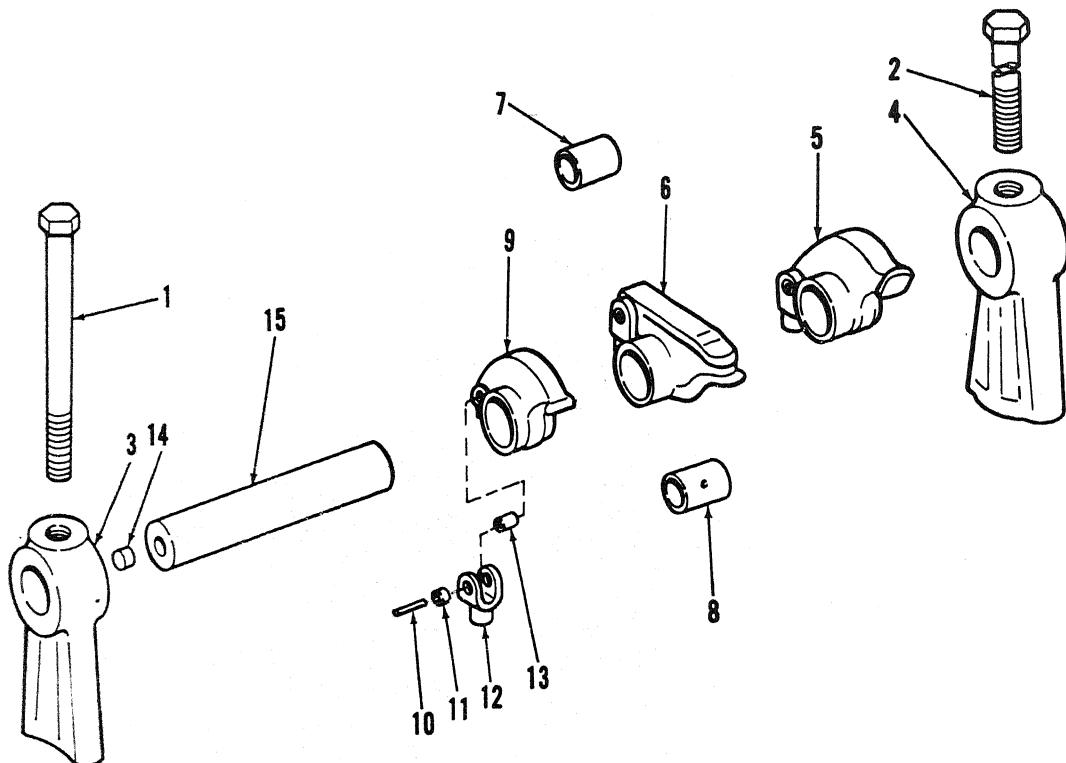
(8) Inspect the cylinder head surface for pitting, scratches, or other damage. Resurface the head or replace as necessary.

e. Reassembly

(1) Reassemble the cylinder head in the reverse numerical sequence as illustrated on figure 22-2.

(2) Follow the cylinder head tightening sequence shown on figure 22-3. Torque head bolts to 175-185 ft. lb.

(3) Install the rocker arms and shafts (para 42).



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1	Bolt	6	Arm assembly	11	Bushing
2	Bolt	7	Bushing	12	Clevis
3	Bracket	8	Bushing	13	Bushing
4	Bracket	9	Arm assembly	14	Plug
5	Arm assembly	10	Pin	15	Shaft

Figure 21-2. Rocker arms and shaft, exploded view.

f. Installation

(1) Refer to figure 22-1 and install the cylinder head.

(2) Complete the cylinder head installation by reversing the instructions outlined under "Cylinder Head Removal."

(3) Adjust the exhaust valves and time the injectors (Operator's Manual).

1 Pan

The engine oil pan is located of the engine and is secured by

twenty six bolts. The oil pan serves as a reservoir for the engine lubricating system and as a housing for the lower internal engine parts. A gasket is located between the pan and the cylinder block to prevent loss of oil.

b. Removal

(1) Remove the power unit (para 23).

(2) Drain the oil (Operator's Manual).

(3) Remove bolts, gasket, and oil pan from the engine block.

c. Disassembly. Refer to figure 23 and disassemble the oil pan assembly.

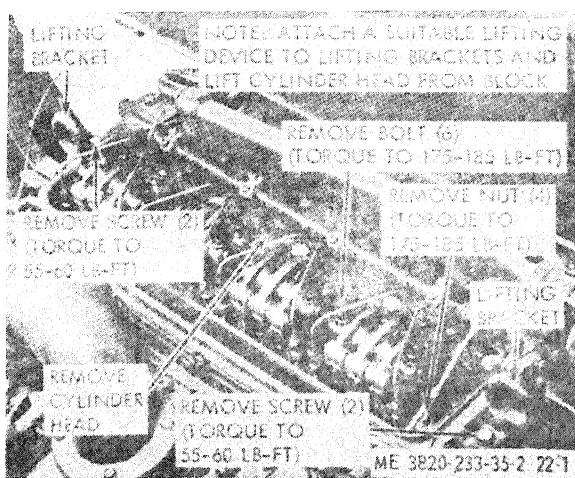


Figure 22-1. Cylinder head, removal and installation.

d. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the oil pan for dents and punctures. Replace an excessively damaged oil pan.

(3) Replace the oil pan gasket.

(4) Inspect the mounting bolts and drain plugs for damaged threads. Replace damaged parts as necessary.

e. Reassembly. Refer to figure 23 and reassemble the oil pan assembly.

f. Installation

(1) Secure the oil pan gasket and oil pan to the engine block.

(2) Install the power unit (para 23).

(3) Refill with engine oil (Operator's Manual).

45. Lubricating Oil Pump and Pressure Regulator Assembly

a. General. The gear type lubricating oil pump is mounted on the first and second main bearing caps, and is gear driven from the front end of crankshaft. An integral plunger type relief valve bypasses the oil to the inlet side of the pump when the pressure in the lubrication system exceeds 105 psi.

b. Removal

(1) Drain the engine oil (Operator's Manual).

(2) Remove the power unit (para 23).

(3) Remove the engine oil pan (para 44).

(4) Remove the engine lubricating oil pump and pressure regulator assembly from the bearing caps as illustrated on figure 24-1.

c. Disassembly. Disassemble the oil pump and pressure regulator assembly in the numerical sequence as illustrated on figure 24-2.

d. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the pump gears for cracked, scored, worn, or clipped teeth. Replace a defective gear.

(3) Inspect shafts for scoring and wear. Replace a defective shaft.

(4) Inspect all bushings for distortion or wear. Replace defective or worn bushings.

(5) Inspect gear pockets finished surfaces for scratches, scoring, or wear. Replace the pump body and cover if wear is indicated.

(6) Inspect the pressure relief valve and its seat in the pump body for wear or other damage. Replace defective parts as necessary.

(7) Check relief valve spring compression. A force of 48—53 pounds is required to compress the spring to a length of 1.596 inch. Replace the spring if a load of less than 48 pounds will compress the spring to 1.596 inch.

(8) Inspect regulator valve for freedom of movement in the regulator body. Replace a defective regulator valve.

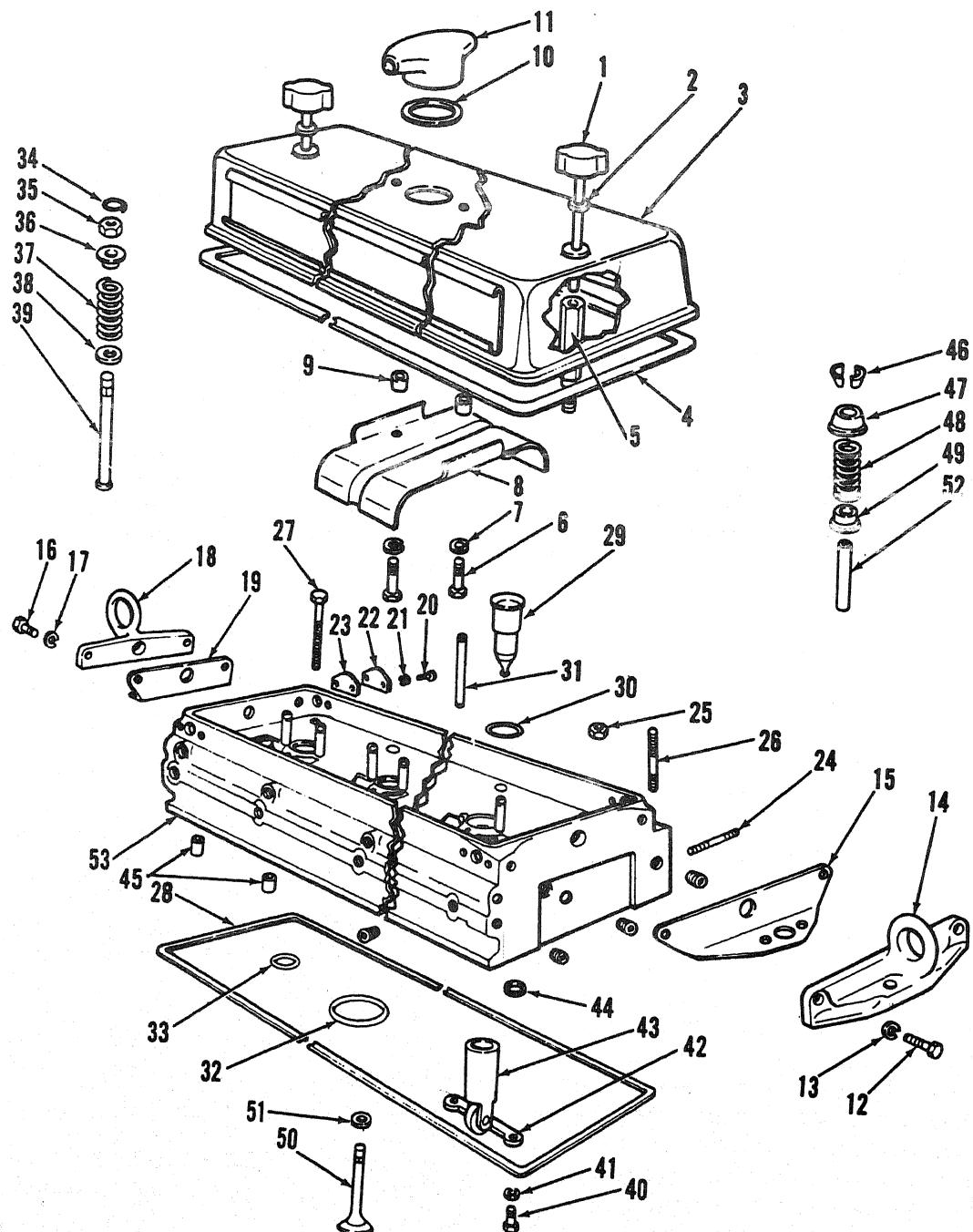
(9) Check pressure regulator spring compression. A force of 14—15 pounds is required to compress the spring to a length of 1.656 inch. Replace the spring if a load of less than 14 pounds will compress the spring to 1.656 inch.

e. Reassembly. Reassemble the lubricating oil pump and pressure regulator assembly in the reverse of the numerical sequence as illustrated on figure 24-2.

f. Installation

(1) Refer to figure 24-1 and install the lubricating oil pump and pressure regulator assembly.

Note. If new gears were installed on the oil pump, it will be necessary to reshim the pump to obtain proper backlash between the crankshaft gear and oil pump idler gear. Correct backlash is 0.002 inch to 0.012 inch. The insertion of one 0.005 inch shim under each side increase the backlash 0.0035 inch.

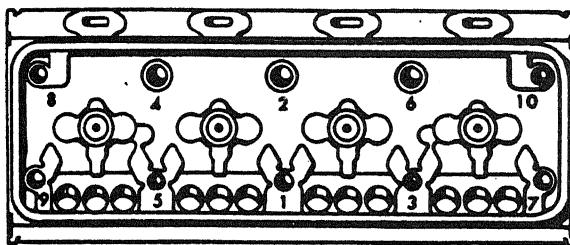


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Figure 22-2. Cylinder head, exploded view.

1	Bolt	19	Gasket	37	Spring
2	Washer	20	Bolt	38	Seat
3	Cover assembly	21	Lockwasher	39	Rod
4	Gasket	22	Cover	40	Bolt
5	Stud	23	Gasket	41	Lockwasher
6	Bolt	24	Stud	42	Guide
7	Lockwasher	25	Nut	43	Follower assembly
8	Baffle	26	Stud	44	Ring
9	Spacer	27	Bolt	45	Nozzle
10	Gasket	28	Gasket	46	Lock
11	Breather	29	Tube	47	Cap
12	Bolt	30	Ring	48	Spring
13	Lockwasher	31	Push rod	49	Seat
14	Bracket	32	Ring	50	Valve
15	Gasket	33	Ring	51	Insert
16	Bolt	34	Retainer	52	Guide
17	Lockwasher	35	Locknut	53	Head assembly
18	Bracket	36	Seat		

Figure 22-2—Continued



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Figure 22-3. Cylinder head tightening sequence.

- (2) Install the oil pan (para 44).
- (3) Install the power unit (para 23).
- (4) Refill with engine (Operator's Manual).

46. Piston and Connecting Rod Assemblies

a. General. The piston and connecting rod assemblies consist of the pistons, pins, bushings, piston rings, connecting rods, and bearings. The pistons have six rings each, four above the piston pin and two below. The rings above the pin are compression rings which form an airtight seal between the pistons and cylinder liners. The rings below the pin are oil control rings which scrape the excess oil from the cylinder wall.

b. Removal

- (1) Drain the engine oil (Operator's Manual).

- (2) Remove the power unit (para 23).
- (3) Remove the muffler and air cleaner (Operator's Manual).
- (4) Remove the hoods, side panels, and tie rods (Operator's Manual).
- (5) Remove the cylinder head (para 43).
- (6) Remove the oil pan (para 44).
- (7) Remove the lubricating oil pump (para 45).
- (8) Refer to figure 25-1 and remove the piston and connecting rod assemblies.

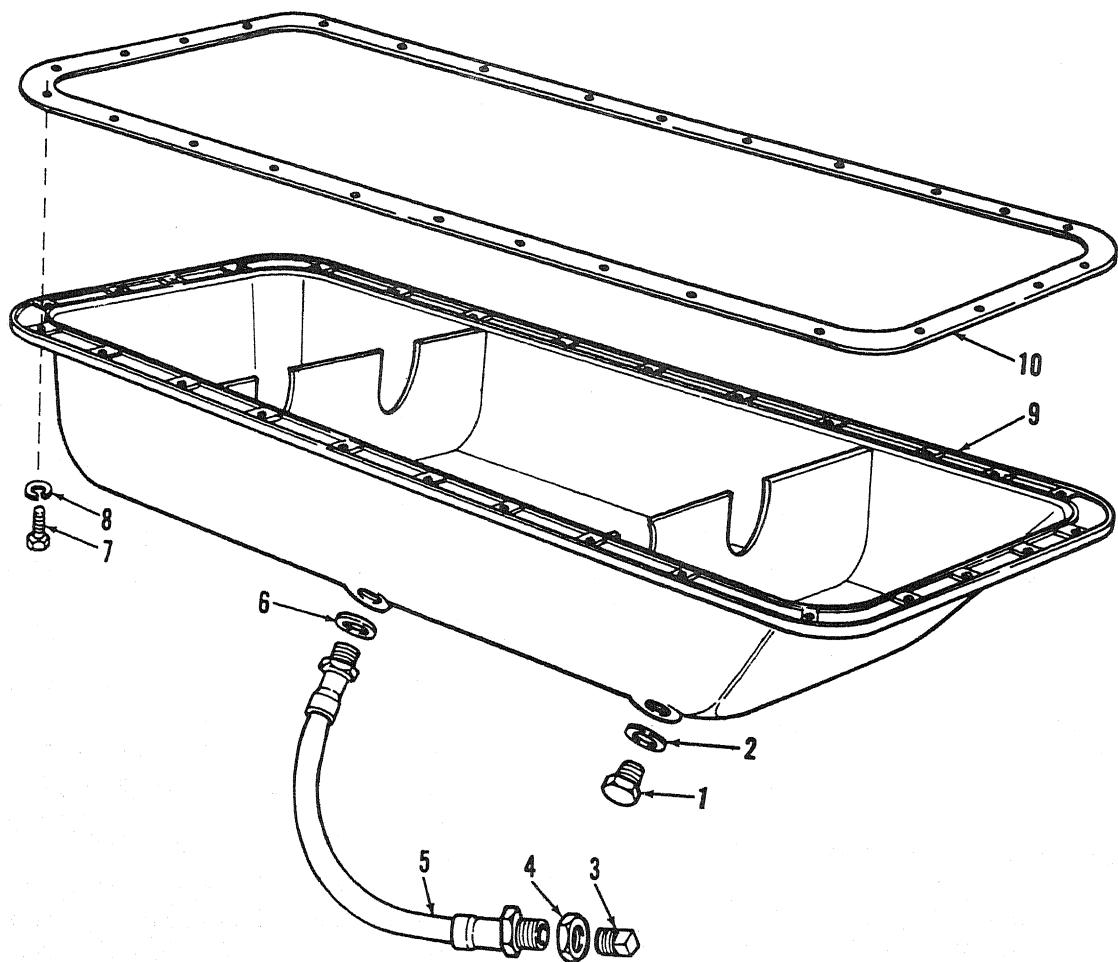
Note. Ridge ream carbon deposits from the upper inner surface of the cylinder liner before removing the piston and connecting rod assemblies.

c. Disassembly. Disassemble the piston and connecting rod assemblies in the numerical sequence as illustrated on figure 25-2.

d. Cleaning, Inspection, and Repair

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the pistons for wear, cracks, scoring and damage. Replace a defective piston.
- (3) Measure the pistons and bore in the cylinder sleeves for clearance (table 1). Replace defective parts.
- (4) Inspect the piston rings for fit in the grooves, clearance, and wear. Refer to table 1 for tolerances. Replace defective piston rings as necessary.

(5) Inspect and measure the inside dimension of the piston pin bushings for wear (table 1). Replace defective bushings as necessary.



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1	Plug	5	Tube assembly	9	Pan
2	Gasket	6	Gasket	10	Gasket
3	Plug	7	Bolt		
4	Nut	8	Lockwasher		

Figure 23. Oil pan assembly, exploded view.

(6) Inspect and measure the outside diameter of the piston pin for wear (table 1). Replace a defective piston pin.

(7) Inspect the bearing shells for scoring, pitting, flaking, chipping, cracking, or signs of overheating. Inspect the backs of the bearing shells for bright spots which indicate the bearings have been moving in their sup-

ports. If any of these conditions exist, replace the bearing shells.

Note. If either the upper or lower bearing shell needs replacing, both shells must be replaced.

e. Reassembly. Reassemble the piston and connecting rod assemblies in the reverse of the numerical sequence as illustrated on figure 25-2.

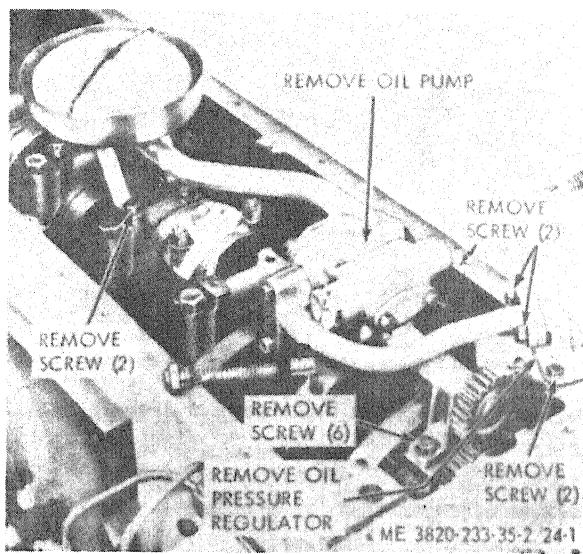


Figure 24-1. Oil pump and pressure regulator assembly, removal and installation.

f. Installation

- (1) Refer to figure 25-1 and install the piston and connecting rod assemblies.
- (2) Install the lubricating oil pump (para 45).
- (3) Install the oil pan (para 44).
- (4) Install the cylinder head (para 43).
- (5) Refer to the Operator's Manual and install the hoods, side panels, and tie rods.
- (6) Refer to the Operator's Manual and install the muffler and air cleaner.
- (7) Install the power unit (para 23).
- (8) Refill with engine oil (Operator's Manual).

47. Power Takeoff Assembly

a. General. The power takeoff is used to engage and disengage the engine power to the plant. The power takeoff clutch is a 14 inch, three piece single plate, dry disc type.

b. Removal

- (1) Remove the power unit from the plant (para 23).
- (2) Remove the air cleaner and muffler (Operator's Manual).
- (3) Remove the hoods, side panels, and tie rods (Operator's Manual).
- (4) Remove pulley from the drive shaft.

(5) Refer to figure 26-1 and remove the power takeoff.

Caution: Do not allow the clutch assembly to tip or turn when being removed. This could damage the clutch pilot bearing.

c. Disassembly. Disassemble the power takeoff assembly in the numerical sequence as illustrated on figure 26-2.

d. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the ball and roller bearing for pitting, corrosion, and rough spots. Replace a defective bearing.

(3) Inspect clutch facings for wear, overheating, or scoring. Inspect clutch facing teeth for wear or damage. Replace a defective clutch facing.

(4) Inspect clutch pressure plates for flatness, cracks, signs of overheating or damage. Replace a defective pressure plate.

(5) Inspect all parts for excessive wear or damage. Replace defective parts as necessary.

e. Reassembly

(1) Reassemble the power takeoff assembly in the reverse of the numerical sequence as illustrated on figure 26-2.

(2) After the clutch has been assembled, keep it engaged until the power takeoff is assembled to the engine.

(3) Refer to para 4 for torque data.

f. Installation

(1) Refer to figure 26-1 and install the power takeoff assembly.

(2) Install pulley to the drive shaft.

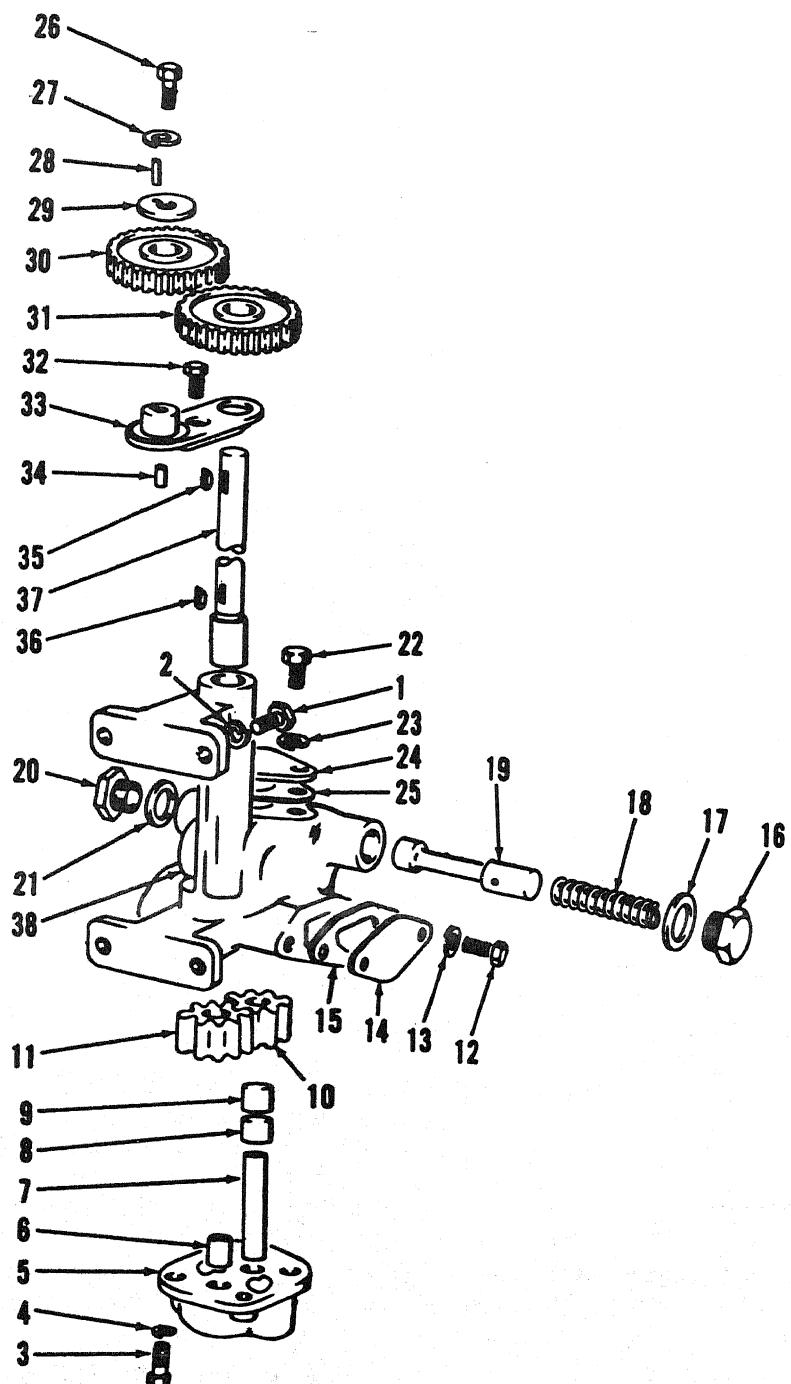
(3) Refer to the Operator's Manual and install the hoods, side panels, and tie rods.

(4) Refer to the Operator's Manual and install the air cleaner and muffler.

(5) Install the power unit (para 23).

48. Flywheel and Flywheel Housing

a. General. The engine flywheel housing is mounted on the cylinder block rear end plate and serves as the housing for the flywheel and gear train. The flywheel is bolted and dowelled securely to the end of the crankshaft. A steel ring gear is shrunk fit onto the rim



A - OIL PUMP

ME 3820-233-35-2/24-2 ①

Figure 24-2 (1). Oil pump and pressure regulator, exploded view.

1	Bolt	14	Cover	27	Washer
2	Lockwasher	15	Gasket	28	Pin
3	Bolt	16	Plug	29	Washer
4	Lockwasher	17	Gasket	30	Gear
5	Cover	18	Spring	31	Gear
6	Bushing	19	Valve	32	Bolt
7	Shaft	20	Plug	33	Support
8	Bushing	21	Gasket	34	Dowel
9	Bushing	22	Bolt	35	Key
10	Gear	23	Lockwasher	36	Key
11	Gear	24	Cover	37	Shaft
12	Bolt	25	Gasket	38	Body
13	Lockwasher	26	Bolt		

Figure 24-2 (1)—Continued

of the flywheel and is the mating gear for the starting motor. The flywheel maintains even crankshaft speed and with the engine starter, provides a method of starting the engine.

b. Removal

- (1) Remove the power unit (para 23).
- (2) Remove the muffler and air cleaner (Operator's Manual).
- (3) Remove the hoods, side panels, and tie rods (Operator's Manual).
- (4) Remove the starter (Operator's Manual).
- (5) Remove the oil pan (para 44).
- (6) Remove the power takeoff assembly (para 47).
- (7) Refer to figure 27-1 and remove the flywheel.
- (8) Remove air cleaner brackets, tachometer, overspeed governor, throttle control and linkage from the flywheel housing. (Operator's Manual.)
- (9) Remove the two bolts securing the engine lifter bracket to the cylinder head.
- (10) Refer to figure 27-2 and remove the flywheel housing.

c. Disassembly. Disassemble the flywheel housing in the numerical sequence as illustrated on figure 27-3.

d. Cleaning, Inspection, and Repair.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect ring gear for broken or cracked teeth. If replacement is necessary, remove gear from flywheel with a blunt chisel. Install a new ring gear by heating to expand it and pressing it onto the flywheel.

Caution: Overheating to temperature above 400° F. will soften the gear.

(3) Inspect flywheel housing for cracks and other damage. Replace a damaged flywheel housing.

Note. Remove all old gasket material from the flywheel housing and end plate before installing a new gasket and the housing.

e. Reassembly. Reassemble the flywheel and flywheel housing in the reverse of the numerical sequence as illustrated on figure 27-3.

f. Installation

(1) Refer to figure 27-2 and install the flywheel housing. Follow the bolt tightening illustrations, figure 27-4 and 27-5. Refer to para 4 for torque data.

(2) Refer to figure 27-1 and install the flywheel. Refer to para 4 for torque data.

(3) Use indicator and check the flywheel housing concentricity as shown on figure 27-6.

(a) Adjust each dial indicator to read zero at the twelve o'clock position. Then, rotate the crankshaft one full revolution, taking readings at 45° intervals (8 readings each of the flywheel housing bore and bolting flange face). Stop and remove the wrench or cranking bar before recording each reading to ensure accuracy. The maximum total indicator reading must not exceed .013 inch for either the bore or face.

(4) Remove the bolts holding the lifter bracket to the flywheel housing. Install a new gasket to the bracket, then alternately tighten the bracket-to-flywheel housing and bracket-to-cylinder head bolts, thus drawing the

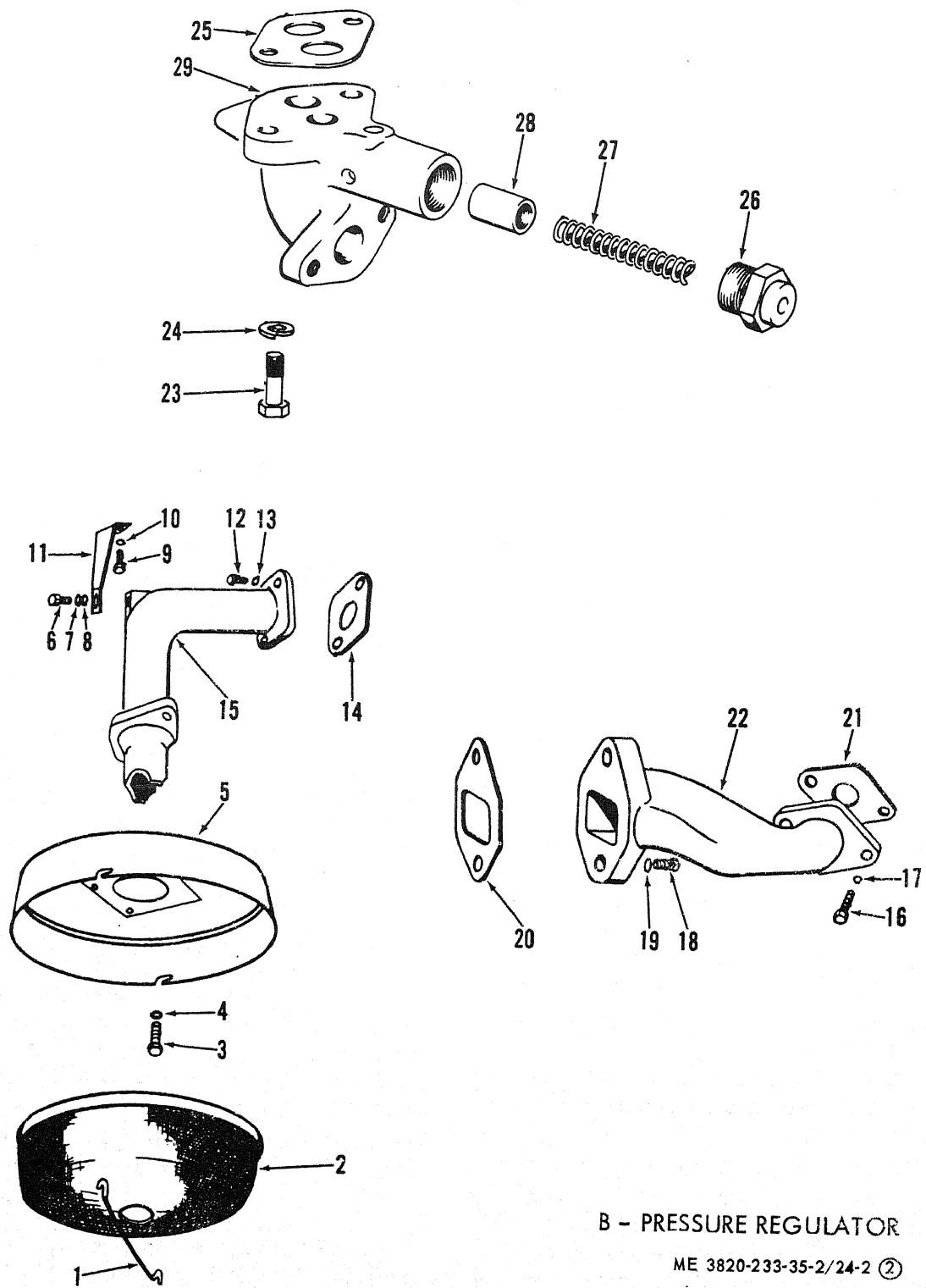


Figure 24-2 (2)—Continued.

ME 3820-233-35-2/24-2 ②

1 Retainer	11 Bracket	21 Gasket
2 Screen	12 Bolt	22 Pipe
3 Bolt	13 Lockwasher	23 Bolt
4 Lockwasher	14 Gasket	24 Lockwasher
5 Cover	15 Pipe	25 Gasket
6 Bolt	16 Bolt	26 Plug
7 Lockwasher	17 Lockwasher	27 Spring
8 Lockwasher	18 Bolt	28 Valve
9 Bolt	19 Lockwasher	29 Body
10 Lockwasher	20 Gasket	

Figure 24-2 (2)—Continued

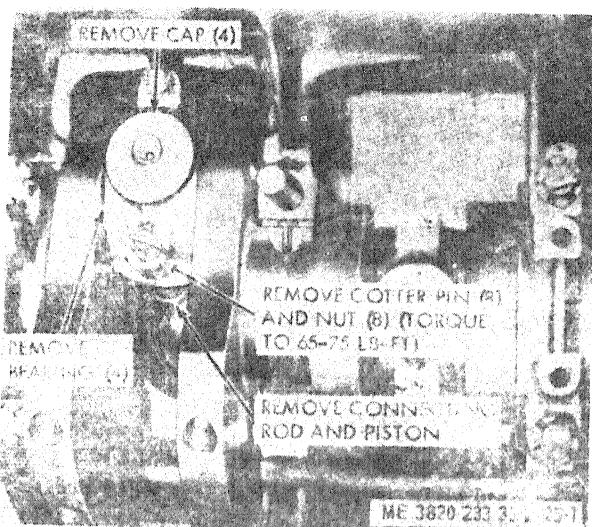


Figure 25-1. Piston and connecting rod, removal and installation.

bracket into the corner formed by the cylinder head and housing.

- (5) Install the oil pan (para 44).
- (6) Install the power takeoff assembly (para 47).
- (7) Refer to the Operator's Manual and install the air cleaner brackets, tachometer, overspeed governor, throttle control and linkage.
- (8) Refer to the Operator's Manual and install the starter.
- (9) Refer to the Operator's Manual and install the hoods, side panels, and tie rods.
- (10) Refer to the Operator's Manual and install the muffler and air cleaner.
- (11) Install the power unit (para 23).

49. Crankshaft Pulley and Front Cover

a. General. The crankshaft pulley is located on the front of the crankshaft outside of the cylinder block. The cooling fan and battery charging generator are driven by the crankshaft pulley. The front cover is located between the pulley and the cylinder block and serves as a housing for the front main bearing oil seal.

b. Removal

- (1) Remove the power unit (para 23).
- (2) Remove the muffler and air cleaner (Operator's Manual).
- (3) Remove the hoods, side panels, and tie rods (Operator's Manual).
- (4) Drain the cooling system.
- (5) Remove the radiator assembly (para 33).
- (6) Remove the fan and generator drive belts (Operator's Manual).

(7) Refer to figure 28-1 and remove the crankshaft pulley and front cover.

c. Disassembly. Disassemble the crankshaft pulley and front cover in the numerical sequence as illustrated on figure 28-2.

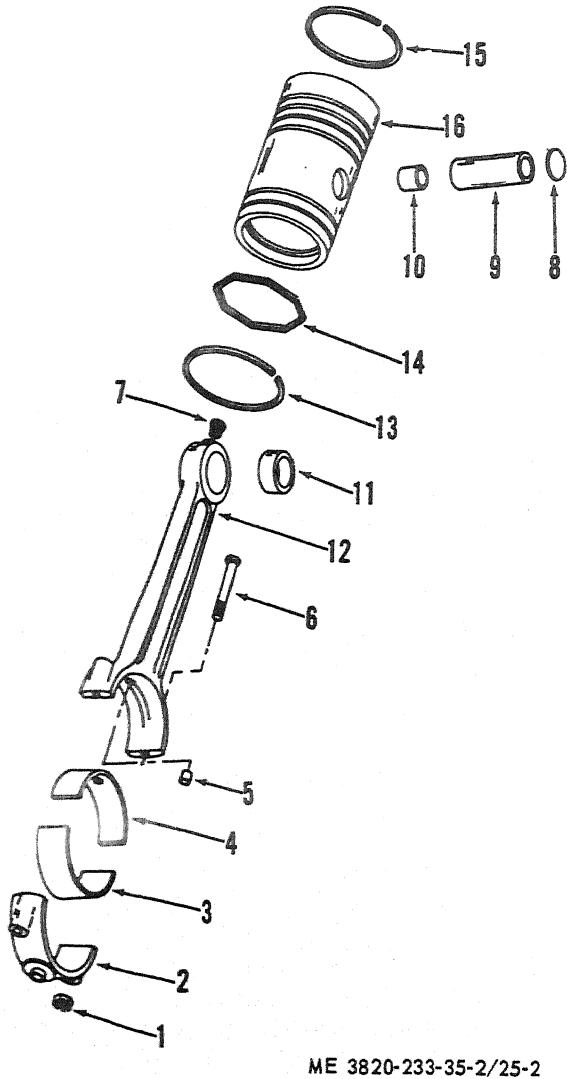
d. Cleaning, Inspection, and Repair

- (1) Clean all parts with an approved solvent and dry thoroughly.
- (2) Inspect all parts for wear and damage. Replace worn and damaged parts.

e. Reassembly. Reassemble the crankshaft pulley and front cover in the reverse of the numerical sequence as illustrated on figure 28-2.

f. Installation

- (1) Refer to figure 28-1 and install the crankshaft pulley and front cover.
- (2) Refer to the Operator's Manual and install fan and generator drive belts.



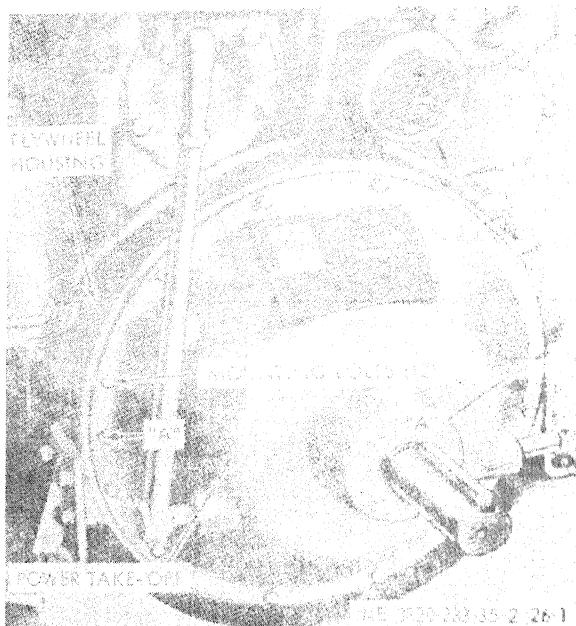
1	Nut	9	Pin
2	Cap	10	Bushing
3	Shell	11	Bushing
4	Shell	12	Rod
5	Orifice	13	Ring
6	Bolt	14	Ring
7	Nozzle	15	Ring
8	Retainer	16	Piston

Figure 25-2. Connecting rod and piston.

(3) Install the radiator assembly (para 33).

(4) Refer to the Operator's Manual and install the hoods, side panels, and tie rods.

2-32



STEP 1. ATTACH A SUITABLE LIFTING TO POWER TAKEOFF ASSEMBLY
 STEP 2. ENGAGE THE CLUTCH
 STEP 3. REMOVE POWER TAKEOFF MOUNTING BOLTS.
 STEP 4. INSTALL TWO OF THE MOUNTING BOLTS IN HOLES "A", AND PUSH ASSEMBLY FROM FLYWHEEL HOUSING.
 STEP 5. PULL POWER TAKEOFF STRAIGHT BACK FROM ENGINE.

Figure 26-1. Power takeoff, removal and installation.

(5) Refer to the Operator's Manual and install the muffler and air cleaner.

(6) Install the power unit (para 23).

(7) Fill the cooling system.

50. Fan Pulley and Hub Assembly

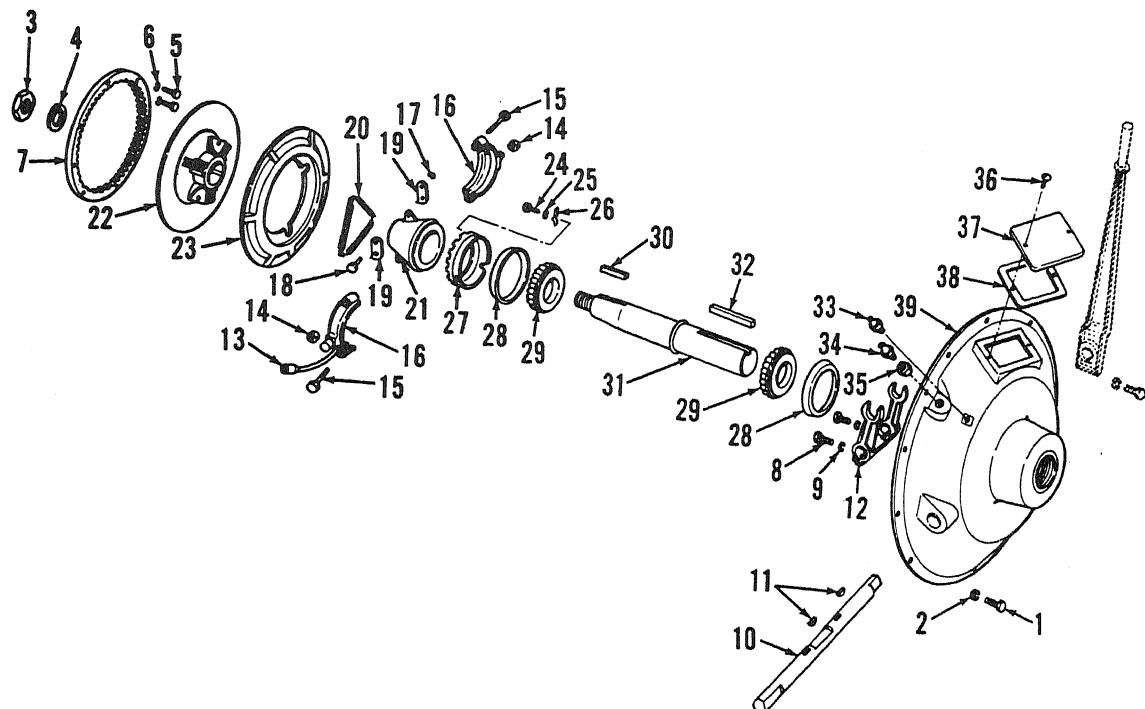
a. *General.* The fan pulley and hub assembly is mounted on the engine balance weight cover. The assembly supports the fan and provides adjustment for the fan belts.

b. Removal and Disassembly

(1) Refer to the Operator's Manual and remove the muffler and air cleaner.

(2) Refer to the Operator's Manual and remove the hoods, side panels, and tie rods.

(3) Remove radiator inlet hose.



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1	Bolt	14	Nut	27	Retainer
2	Lockwasher	15	Bolt	28	Bearing cup
3	Nut	16	Collar	29	Bearing cone
4	Lockwasher	17	Ring	30	Key
5	Bolt	18	Pin	31	Shaft
6	Lockwasher	19	Link	32	Key
7	Driving ring	20	Spring	33	Fitting
8	Bolt	21	Sleeve	34	Fitting
9	Lockwasher	22	Plate	35	Nut
10	Shaft	23	Plate	36	Screw
11	Key	24	Bolt	37	Cover
12	Yoke	25	Lockwasher	38	Gasket
13	Hose	26	Lock	39	Housing

Figure 26-2. Power takeoff, exploded view.

(4) Refer to figures 29-1 and 29-2 and remove and disassemble the fan pulley and hub assembly.

c. *Cleaning, Inspection, and Repair*

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect bearings for scoring, pitting, and wear. Replace a defective bearing.

(3) Inspect the fan for visible damage. Replace a defective fan.

(4) Inspect all parts for cracks, breaks, and other damage. Repair or replace defective parts.

d. *Reassembly and Installation*

(1) Refer to figures 29-1 and 29-2, and reassemble and install the pulley and hub assembly.

(2) Torque the bearing retainer bolt (11) to 83-93 ft. lb.

(3) Install radiator inlet hose.

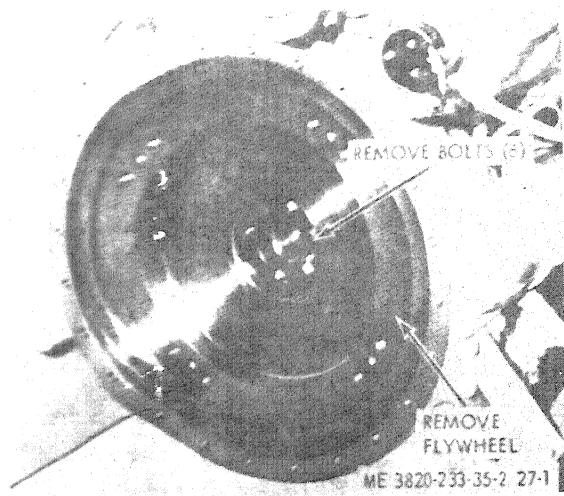


Figure 27-1. Flywheel, removal and installation.

- (4) Install hoods, side panels, and tie rods (Operator's Manual).
- (5) Install the muffler and air cleaner (Operator's Manual).

51. Camshaft and Balance Shaft Assemblies

a. *General.* The camshaft and balance shaft are located near the top of the cylinder block. The camshaft is located on the right side of the cylinder block, and the balance shaft is located on the left side. The camshaft operates the exhaust valves and injectors, and the balance shaft counterbalances the rotation of the weighted camshaft.

b. Removal

- (1) Remove the power unit (para 23).
- (2) Remove the air cleaner and muffler (Operator's Manual).
- (3) Remove the hoods, side panels, and tie rods (Operator's Manual).
- (4) Drain the cooling system.
- (5) Remove the radiator (para 33).
- (6) Remove the fan and hub assembly (para 50).
- (7) Remove the cylinder head (para 43).
- (8) Remove the flywheel and flywheel housing (para 48).
- (9) Refer to figure 30-1 and remove the balance weight cover.
- (10) Refer to figure 30-2 and remove the balancer weights.
- (11) Refer to figure 30-3 and remove the camshaft and balancer shaft assemblies.

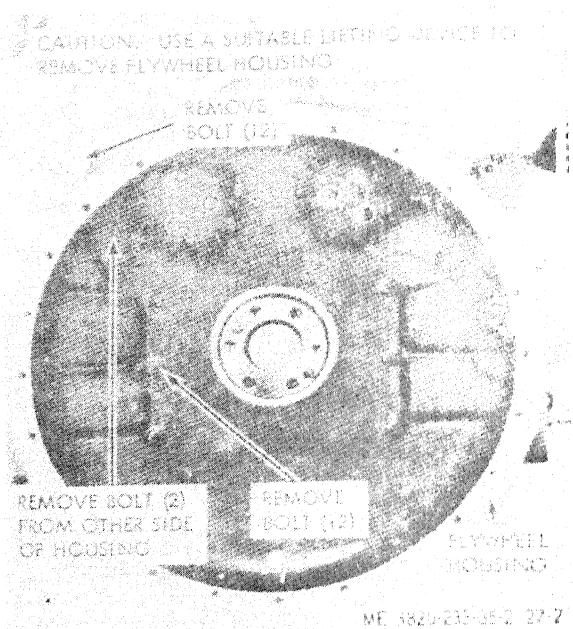
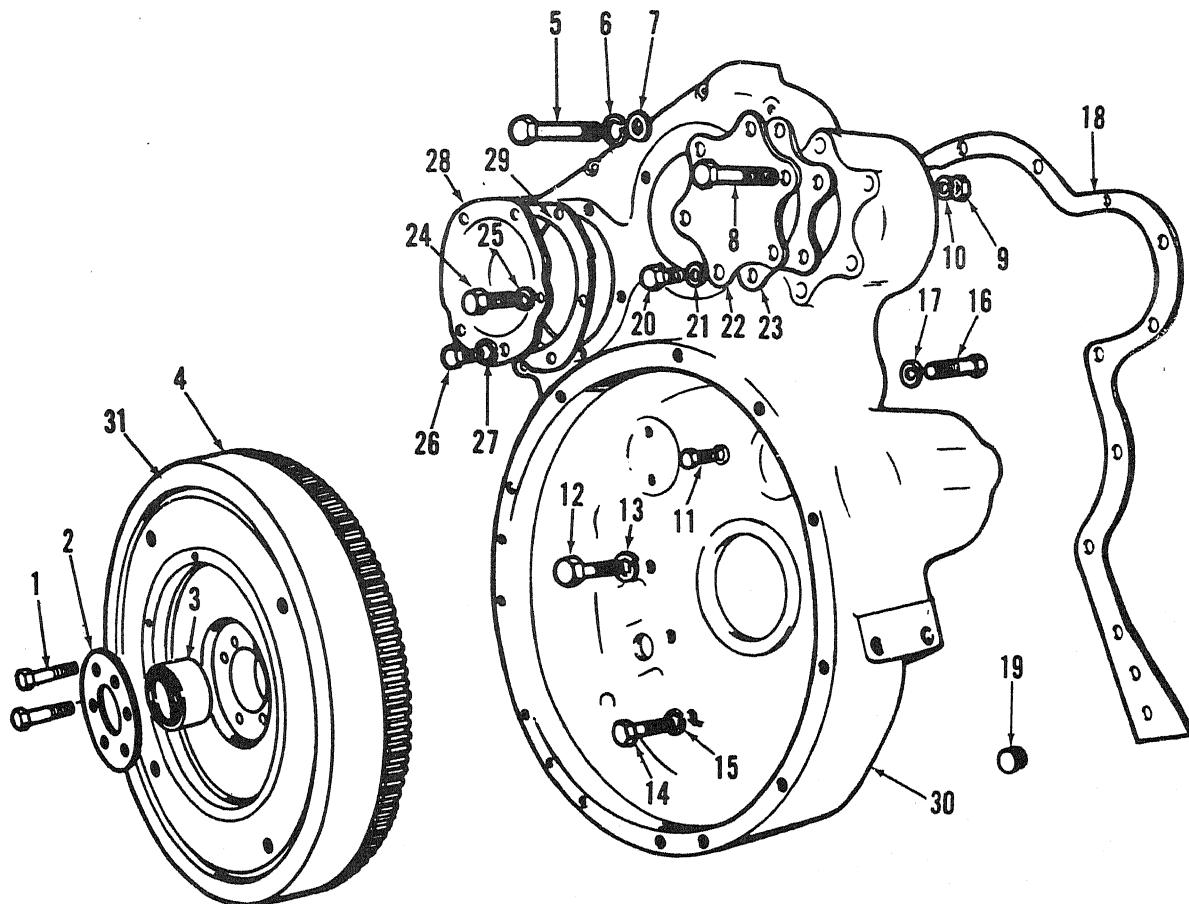


Figure 27-2. Flywheel housing, removal and installation.

c. *Disassembly.* Disassemble the camshaft balancer shaft and idler gear assembly in the numerical sequence as illustrated on figure 30-4.

d. Cleaning, Inspection, and Repair

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the cams and journals for scoring or wear. Replace an excessively scored or worn camshaft.
- (3) Inspect the thrust washers for scoring or wear, and replace as necessary.
- (4) Inspect bearings and bushings for wear or other defects. Replace excessively marred or worn bearings and bushings.
- (5) Measure clearance between camshaft journals and the intermediate bearings (table 1). Replace the bearings if they exceed the wear limits.
- (6) Refer to table 1 for tolerance and clearance data.
- (7) Inspect the gears for chipped teeth and wear. Replace damaged or excessively worn gear.



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1	Bolt	12	Bolt	23	Gasket
2	Retainer	13	Lockwasher	24	Bolt
3	Bearing	14	Bolt	25	Lockwasher
4	Gear	15	Lockwasher	26	Bolt
5	Bolt	16	Bolt	27	Lockwasher
6	Lockwasher	17	Lockwasher	28	Cover
7	Washer	18	Gasket	29	Gasket
8	Bolt	19	Plug	30	Housing
9	Nut	20	Bolt	31	Flywheel
10	Lockwasher	21	Lockwasher		
11	Bolt	22	Cover		

Figure 27-3. Flywheel and flywheel housing, exploded view.

e. Reassembly. Reassemble the camshaft and balance shaft in the reverse of the numerical sequence as illustrated on figure 30-4.

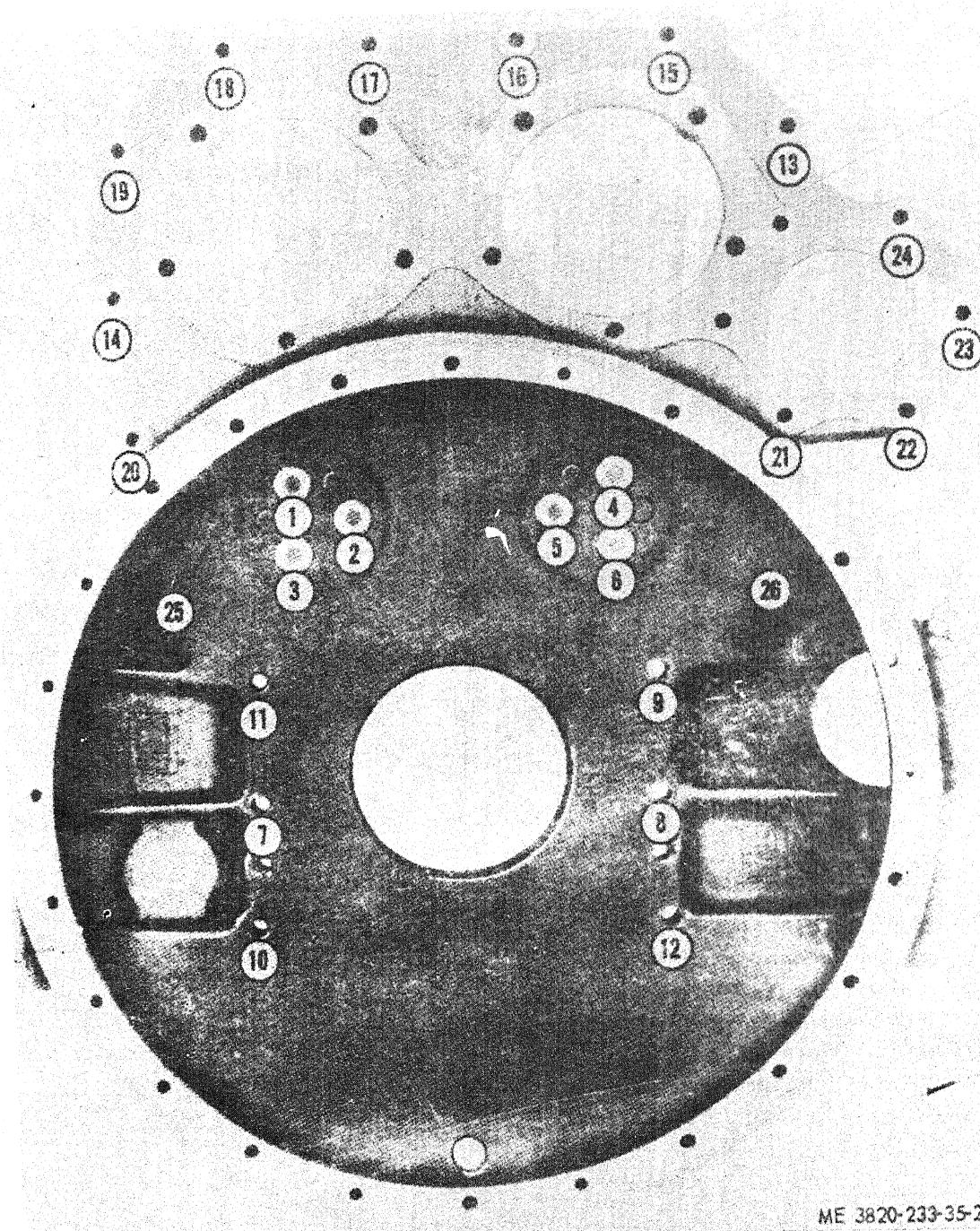
f. Installation

(1) Aline the timing marks (O-O and R-R) and install the camshaft and balancer shaft assemblies as instructed on figures 30-3.

(2) Reverse steps 1 through 10 under "Camshaft and balance shaft assembly removal".

52. Gear Train

a. General. The completely enclosed gear train, consisting of five helical gears, is located

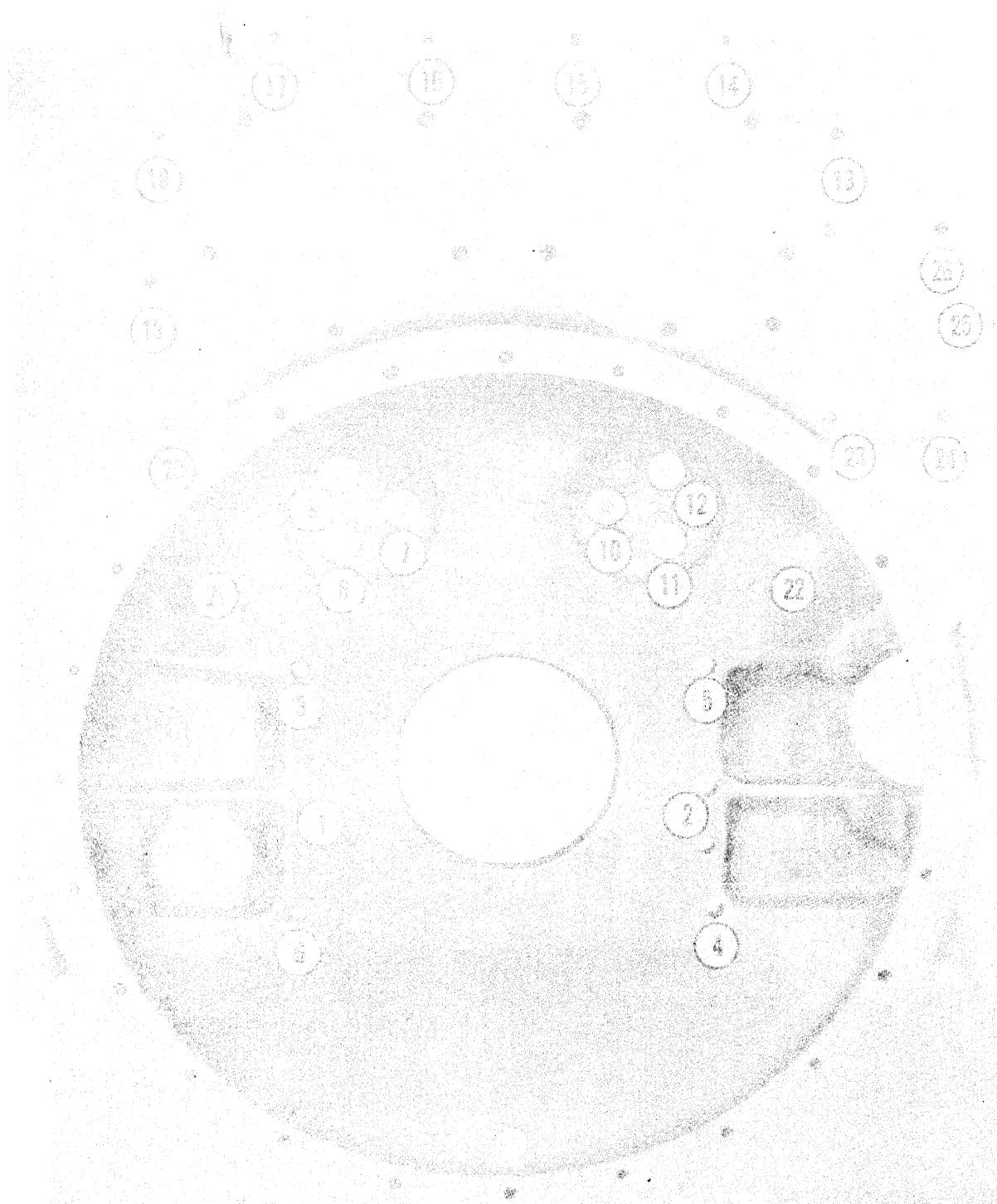


ME 3820-233-35-2 27-4

Figure 27-4. Initial bolt tightening sequence.

at the rear of the engine. The crankshaft timing gear drives the camshaft gear and balance shaft gear through the idler gear. The camshaft gear and balance shaft gear are in mesh with

one another and rotate at the same speed as the crankshaft. The blower drive gear, driven by the balance shaft gear, drives the blower, governor, fuel pump, and water pump.



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Figure 27-5. Final bolt tightening sequence.

b. Removal

- (1) Remove the power unit (para 23).
- (2) Refer to the Operator's Manual and remove the muffler and air cleaner.
- (3) Refer to the Operator's Manual and remove the hoods, side panels, and tie rods.
- (4) Remove the flywheel and flywheel housing (para 48).
- (5) Remove the blower drive gear (para 37).
- (6) Remove the crankshaft gear (para 53).
- (7) Remove the camshaft and balancer shaft gears, and idler gear assembly (para 51).

c. Cleaning, Inspection, and Repair

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect idler gear for chipped teeth and wear. Replace a defective gear.
- (3) Inspect idler gear bearing for scoring, pitting, wear, and overheating. Replace a defective bearing.
- (4) Gear train noise usually indicates excessive gear lash, scoring, pitting or bearing wear. A rattling noise is an indication of excessive gear lash, whereas a whining noise is a result of too little gear lash. The correct backlash for the gear train is 0.003 to 0.008 inch.

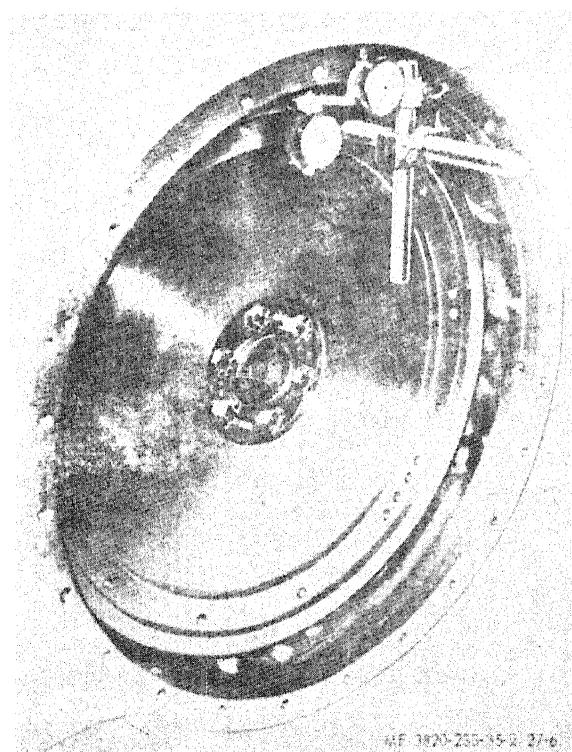


Figure 27-6. Checking flywheel housing concentricity.

cessive gear lash, scoring, pitting or bearing wear. A rattling noise is an indication of excessive gear lash, whereas a whining noise is a result of too little gear lash. The correct backlash for the gear train is 0.003 to 0.008 inch.

d. Installation. Reverse the steps 1 through 7 under "Gear train removal".

Note. Refer to figure 30-3 and install the gears in the gear train with the timing marks (O-O and R-R) as indicated.

53. Crankshaft and Main Bearings

a. General. The crankshaft assembly is located at the bottom of the cylinder block, and is supported by five main bearings. The main bearings are of the replaceable type and are used at each journal. A main bearing consists of two shells. The upper shell is located in crankcase main bearing support and the lower shell is seated in the main bearing cap.

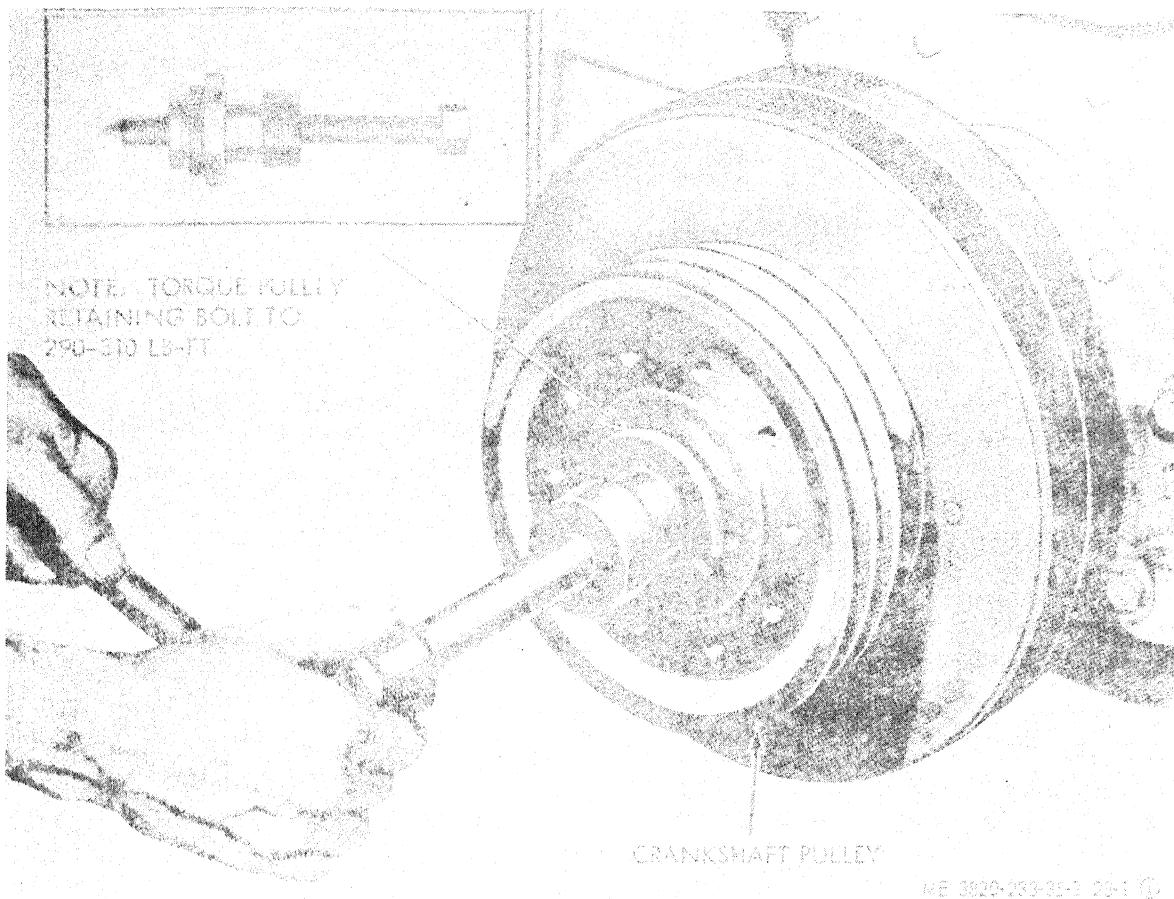
b. Removal

- (1) Drain the engine oil (Operator's Manual).
- (2) Remove the power unit (para 23).
- (3) Remove the muffler air cleaner (Operator's Manual).
- (4) Remove the hoods, side panels, and tie rods (Operator's Manual).
- (5) Drain the cooling system.
- (6) Remove the radiator (para 33).
- (7) Remove the flywheel and flywheel housing (para 48).
- (8) Remove the cylinder head (para 43).
- (9) Remove the oil pan (para 44).
- (10) Remove the lubricating oil pump and pressure regulator (para 45).
- (11) Remove the pistons and connecting rods (para 46).
- (12) Remove the crankshaft pulley and front cover (para 49).
- (13) Refer to figure 31-1 and remove the crankshaft and main bearing.

c. Disassembly. Disassemble the crankshaft and main bearings in the numerical sequence as illustrated on figure 31-2.

d. Cleaning, Inspection, and Repair

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.



STEP 1. REMOVE CRANKSHAFT PULLEY.

Figure 28-1 (1). Crankshaft pulley and front cover, removal and installation.

(2) Perform a magnetic inspection on the crankshaft for cracks, breaks, or indications of fatigue. Replace the crankshaft if any of the above mentioned conditions exist.

(3) Measure the main bearing and connecting rod journals for wear and out-of-roundness. Refer to table 1 for tolerance and clearance data.

(4) Inspect the thrust washers for wear or roughness. Measure washer thickness. Refer to table 1 for correct dimensions and tolerance data. Replace defective washers.

(5) Inspect main bearings for wear, roughness, and overheating. Replace defective bearings.

(6) Check runout of crankshaft journals. Refer to table 1 for correct tolerance and clear-

ance data. If the runout limit is greater than the data given in table 1, replace the crankshaft

(7) Inspect oil pump drive gear and crankshaft timing gear for chipped or cracked teeth. Replace a defective gear.

(8) Measure journal-to-bearing shell clearance. Refer to table 1 for allowable tolerances. Regrind or replace crankshaft as necessary.

Caution: Crankshaft grinding operations must be performed by an adequately equipped shop and fully trained personnel.

Note. When a new or reground crankshaft is installed, install all new main and connecting rod bearing shells.

e. *Reassembly.* Reassemble the crankshaft and main bearings in the reverse of the numerical sequence as illustrated on figure 31-2.

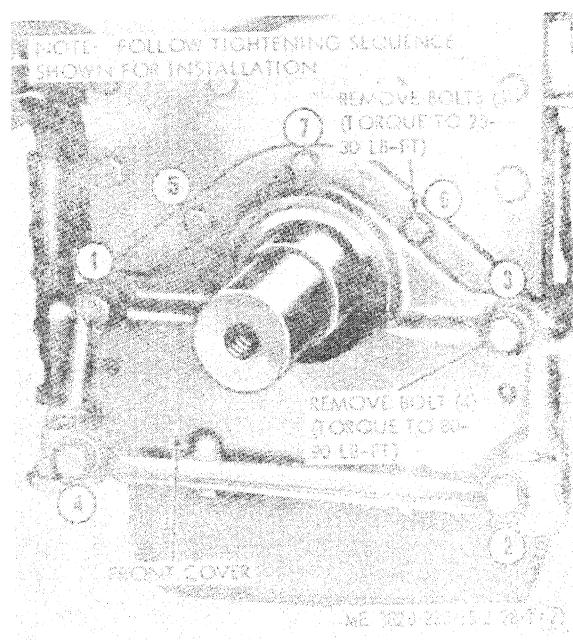
f. *Installation*

(1) Refer to figure 31-1 and install the crankshaft and main bearings.

(2) Reverse the instructions outlined under "Crankshaft and main bearing removal".

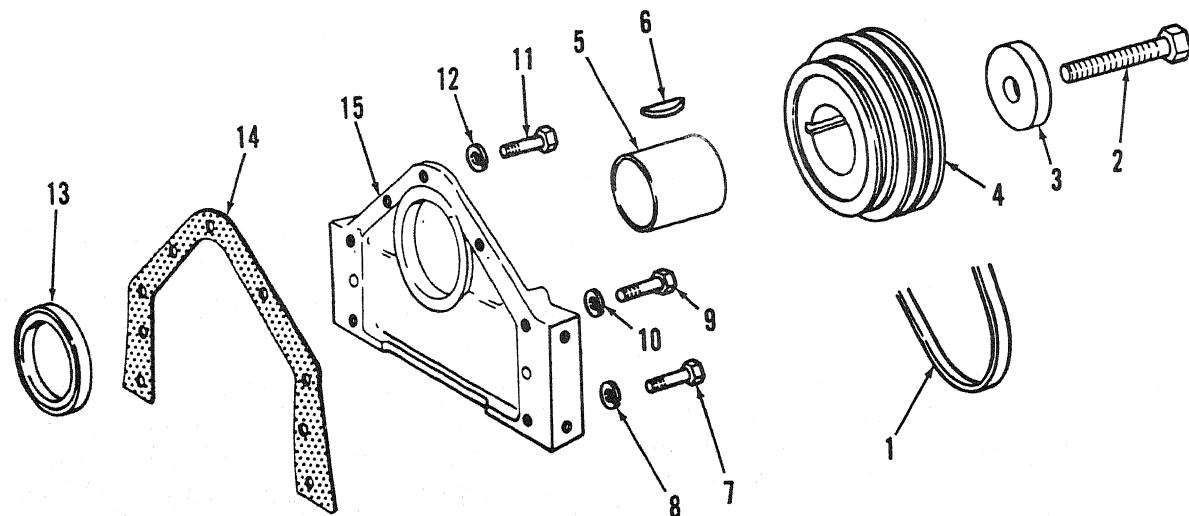
54. Cylinder Block

a. *General.* The cylinder block forms the primary structural part of the engine. Rigidity, strength, and true alignment of the block bores and bearings are provided by integrally cast cross members. The block is bored to receive cylinder liners and two section (upper and lower) water jackets which extend the full length of the bore. Surrounding the water jackets is an air box which conducts air from the blower assembly to the cylinder liners. The cylinder liners are of the replaceable type, accurately machined and heat treated to provide long operating life. The top flange of the liner fits into a recess in the top of the cylinder



STEP 2. REMOVE FRONT COVER.

Figure 28-1 (2)—Continued.



ME 3820-233-35-2/28-2

1	Belt	6	Key
2	Bolt	7	Bolt
3	Retainer	8	Lockwasher
4	Pulley	9	Bolt
5	Insulator	10	Lockwasher

11	Bolt
12	Lockwasher
13	Seal
14	Gasket
15	Cover

Figure 28-2. Crankshaft pulley and front cover, exploded view.

block. An insert located in the cylinder block allows true alignment of the cylinder liner. Lubricating oil is distributed to all moving parts of the engine through drilled passages in the cylinder block.

b. Removal and Disassembly.

(1) Remove the crankshaft and main bearings (para 53).

(2) Disassemble the cylinder block in the numerical sequence as illustrated on figure 32.

c. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Check top surface of cylinder block for flatness. The top surface limits should not exceed 0.003 inch transversely and 0.007 inch longitudinally. Machine cylinder block as necessary.

Caution: Cylinder block machining operations must be performed by an adequately equipped shop and fully trained personnel.

(3) Measure cylinder block bores. Refer to table 1 for correct dimensions. Replace cylinder liners if the bore is more than specified in table 1.

(4) Refer to table 1 for allowable tolerances and clearances. Machine or replace a defective cylinder block.

(5) Check block thoroughly for cracks and corrosion signs of leaking or damage. Repair or replace a defective cylinder block.

(6) Inspect all oil and water passages to make sure they are open.

d. Reassembly and Installation

(1) Reassemble cylinder block in the reverse of the numerical sequence as illustrated on figure 32.

(2) Install the crankshaft assembly (para 53).

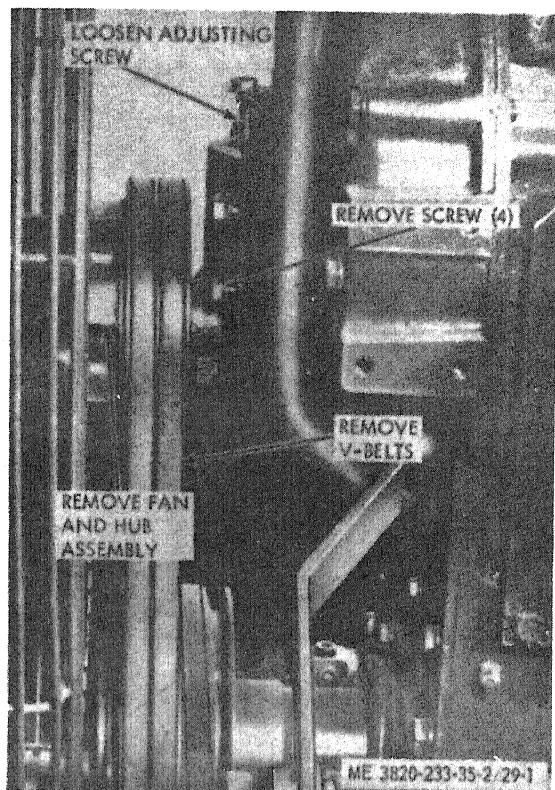
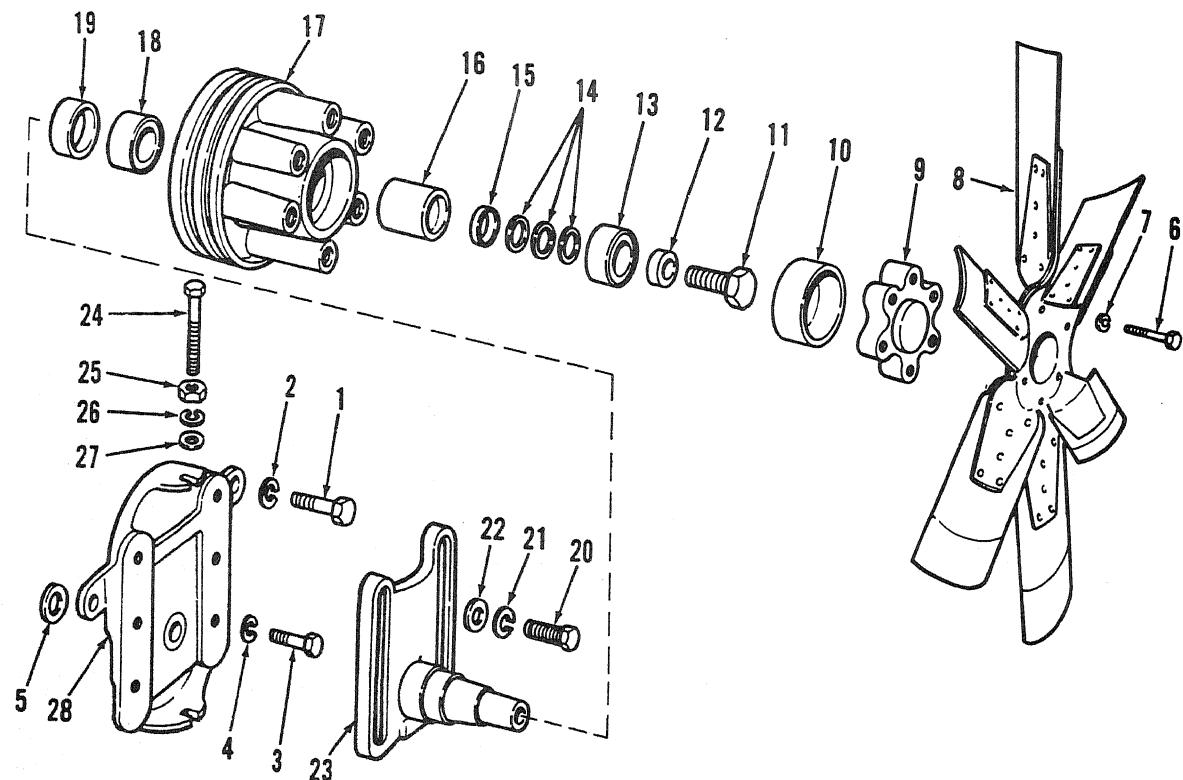


Figure 29-1. Fan and hub assembly, removal and installation.



ME 3820-233-35-2/29-2

1	Bolt	11	Bolt	21	Lockwasher
2	Lockwasher	12	Washer	22	Washer
3	Bolt	13	Bearing	23	Shaft
4	Lockwasher	14	Shim	24	Bolt
5	Spacer	15	Retainer	25	Nut
6	Bolt	16	Spacer	26	Lockwasher
7	Lockwasher	17	Pulley	27	Washer
8	Blade	18	Bearing	28	Support
9	Spacer	19	Seal		
10	Cap	20	Bolt		

Figure 29-2. Fan pulley and hub assembly, exploded view.

NOTE: FOR INSTALLATION FOLLOW
TIGHTENING SEQUENCE SHOWN.
TORQUE SCREWS TO 25-30 LB-FT.

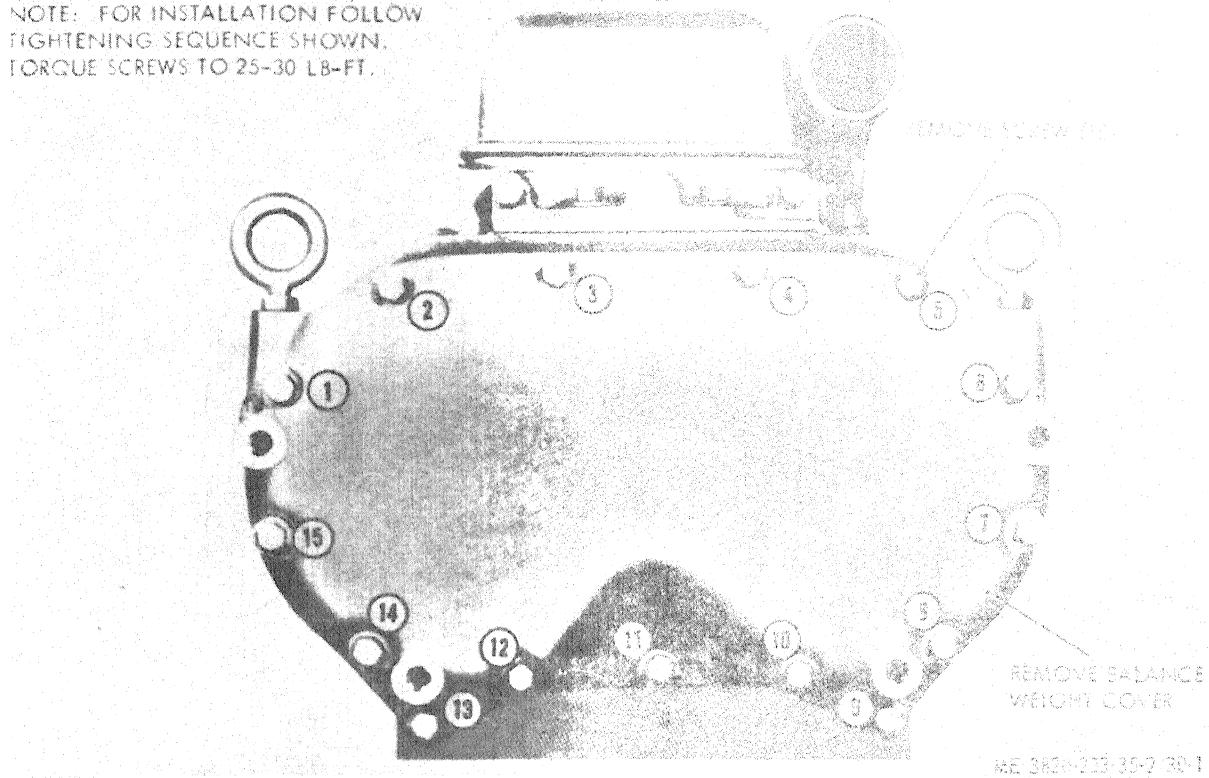


Figure 30-1. Balance weight cover, removal and installation.

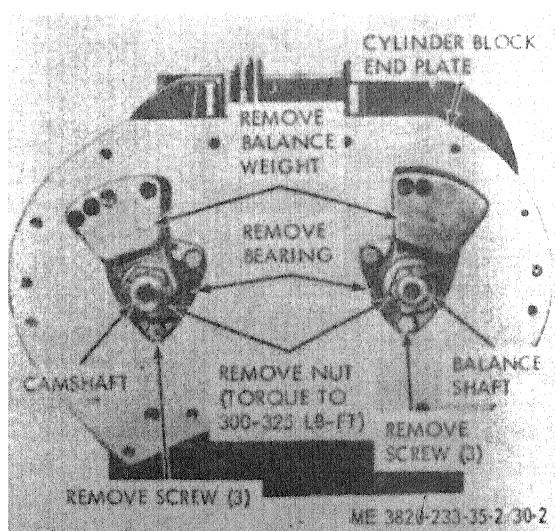


Figure 30-2. Balance weights, removal and installation.

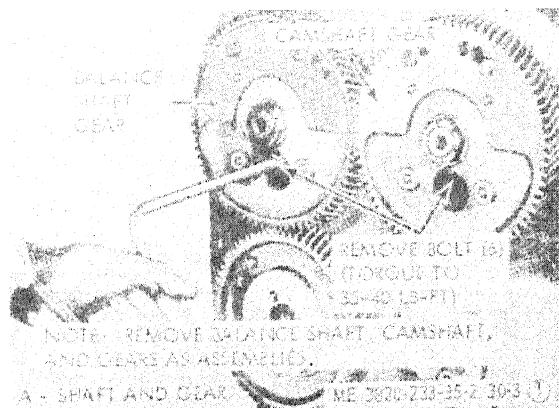


Figure 30-3 (1). Balance shaft and camshaft, removal and installation.

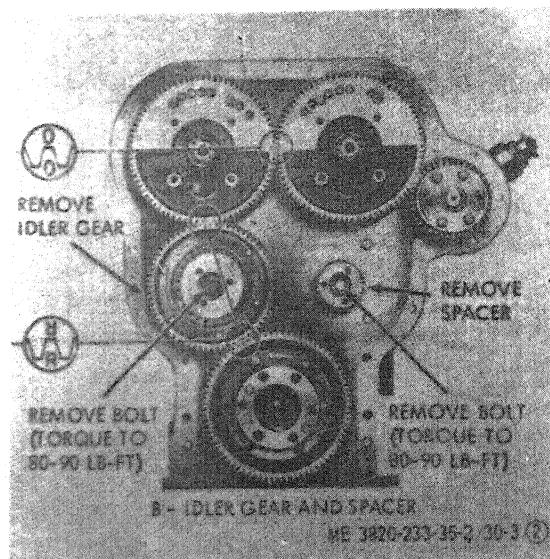
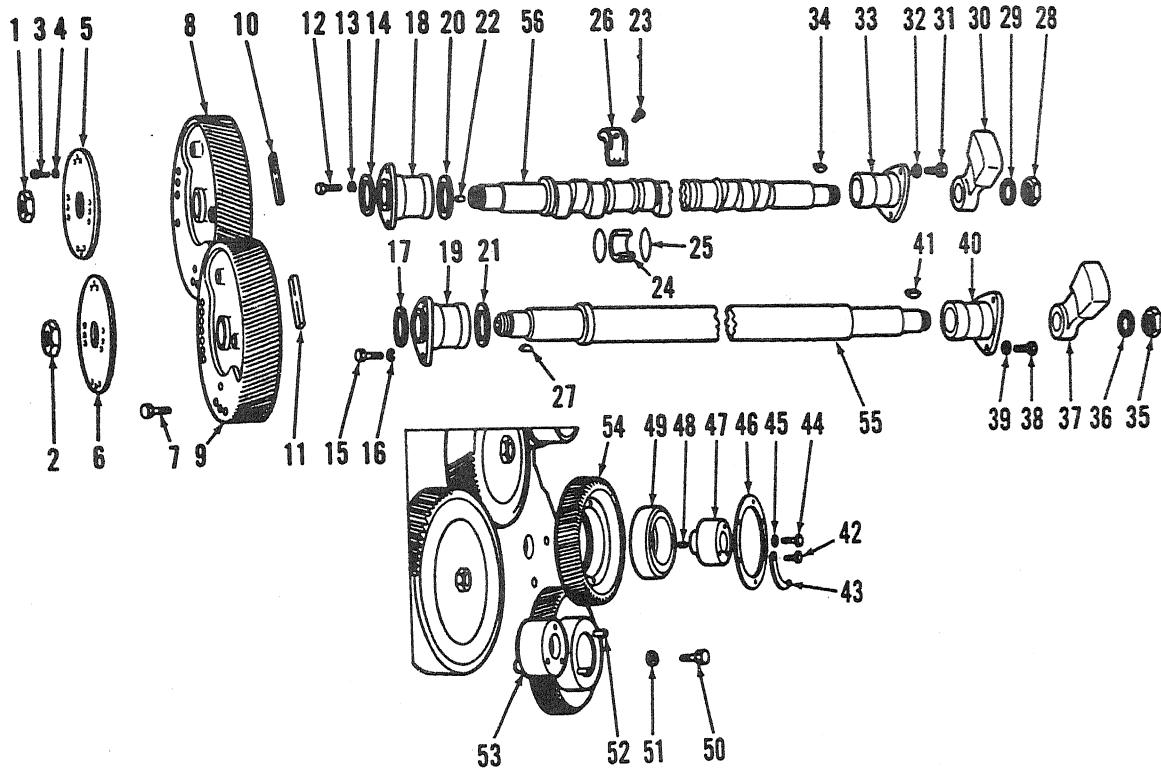


Figure 30-S (2)—Continued.



ME 3820-233-35-2/30-4

1	Nut	20	Washer	39	Lockwasher
2	Nut	21	Washer	40	Bearing
3	Bolt	22	Plug	41	Key
4	Lockwasher	23	Bolt	42	Bolt
5	Retainer	24	Bearing	43	Lock
6	Retainer	25	Ring	44	Bolt
7	Bolt	26	Bearing	45	Washer
8	Gear	27	Key	46	Retainer
9	Gear	28	Nut	47	Hub
10	Weight	29	Lockwasher	48	Dowel
11	Weight	30	Weight	49	Bearing
12	Bolt	31	Bolt	50	Bolt
13	Lockwasher	32	Lockwasher	51	Washer
14	Washer	33	Bearing	52	Dowel
15	Bolt	34	Key	53	Spacer
16	Lockwasher	35	Nut	54	Gear
17	Washer	36	Lockwasher	55	Shaft
18	Bearing	37	Weight	56	Camshaft
19	Bearing	38	Bolt		

Figure 30-4. Camshaft, balance shaft and idler gear assembly, exploded view.

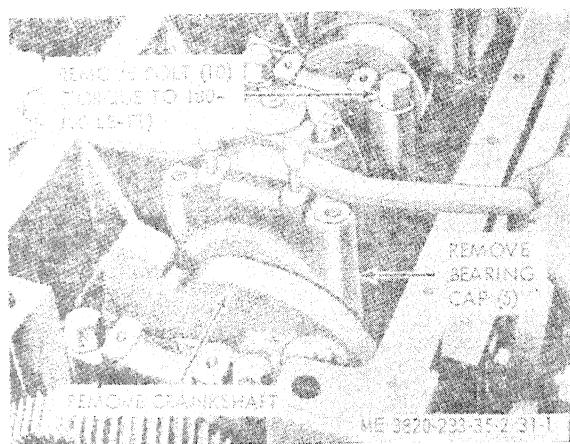
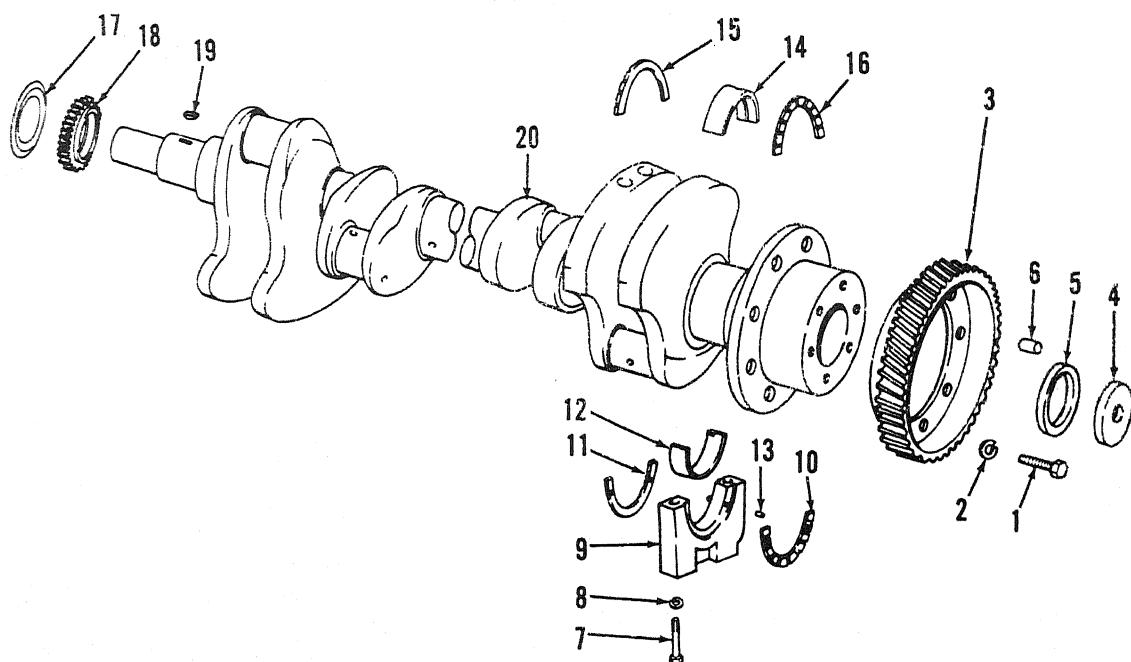


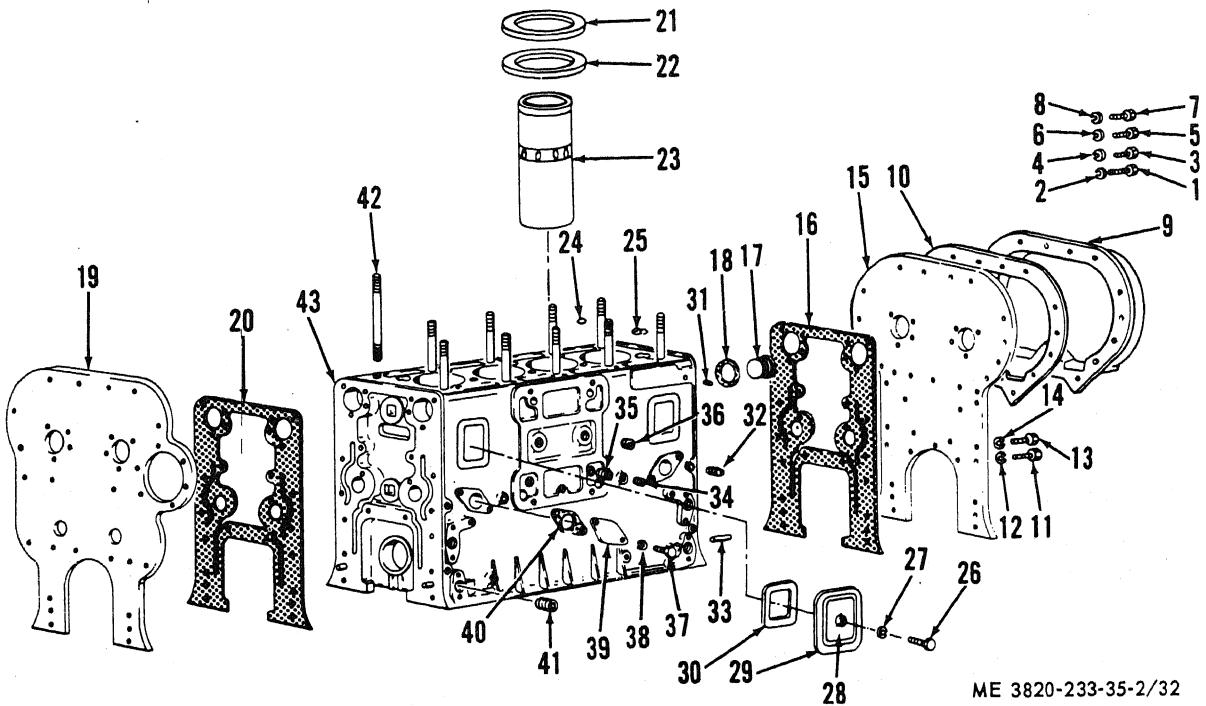
Figure 31-1. Crankshaft and main bearing removal and installation.



ME 3820-233-35-2/31-2

1	Bolt	8	Lockwasher	15	Washer
2	Lockwasher	9	Cap	16	Washer
3	Gear	10	Washer	17	Slinger
4	Baffle	11	Washer	18	Gear
5	Seal	12	Shell	19	Key
6	Dowel	13	Pin	20	Crankshaft
7	Bolt	14	Shell		

Figure 31-2. Crankshaft and main bearing, exploded view.



ME 3820-233-35-2/32

1	Bolt	16	Gasket	31	Plug
2	Lockwasher	17	Plug	32	Plug
3	Bolt	18	Gasket	33	Dowel
4	Lockwasher	19	Plate	34	Plug
5	Bolt	20	Gasket	35	Plug
6	Lockwasher	21	Gasket	36	Plug
7	Bolt	22	Insert	37	Bolt
8	Lockwasher	23	Liner	38	Lockwasher
9	Cover	24	Ring	39	Cover
10	Gasket	25	Ring	40	Gasket
11	Bolt	26	Bolt	41	Plug
12	Lockwasher	27	Washer	42	Stud
13	Bolt	28	Cover	43	Block assembly
14	Lockwasher	29	Gasket		
15	Plate	30	Gasket		

Figure 32. Cylinder block, exploded view.

CHAPTER 4

CRUSHING AND SCREENING PLANT REPAIR INSTRUCTIONS

Section I. ROCK AND SAND CONVEYORS

55. General

The sand conveyor is located on the right side of the plant, and the rock conveyor is located on the left side of the plant. These two side conveyors receive sand and rock from the screen hopper, and deliver it to trucks or onto a stock pile. Both conveyors are hinged so that they can be folded for transports.

56. Rock and Sand Conveyors

a. Removal. Refer to para 24 and remove the rock and sand conveyors.

b. Disassembly. Disassemble the rock and sand conveyors in the numerical sequence as illustrated on figure 33-1.

c. Trough Roll Disassembly

(1) Disassemble the trough roll assembly in the numerical sequence as illustrated on figure 33-2.

(2) To remove bearings (15 and 19), remove nuts (13 and 14) from both ends of the roll and shaft assembly. Tap lightly on one end of the shaft until bearing (15), O-ring (16), washer (17), snap ring (18), and shaft (23) are free of the roll shell. Insert a suitable pusher tool in end of roll shell opposite bearing (19) and remove the bearing.

d. Return Roll Disassembly. Disassemble the return roll assembly in the numerical sequence as illustrated on figure 33-3. Remove bearings (5 and 9) in the same manner as described in step *c* above.

e. Bearing Disassembly. Refer to figure 33-4 and disassemble bearing assemblies (29 and 69, fig. 33-1).

f. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect conveyor frames for serious damage. Repair or replace a damaged frame.

(3) Inspect pulleys for dents, cracks and other damage. Repair or replace a damaged pulley.

(4) Inspect bearings for scoring, pitting, and binding. Replace a defective bearing.

(5) Inspect skirtboards and flashing for wear and damage, and replace if necessary.

(6) Inspect conveyor belts for wear and fraying. Replace a worn or defective belt.

(7) Inspect trough and return roll assemblies to make sure they turn freely. Replace defective component parts or the whole assembly as required.

(8) Inspect all parts for damage, and replace defective parts.

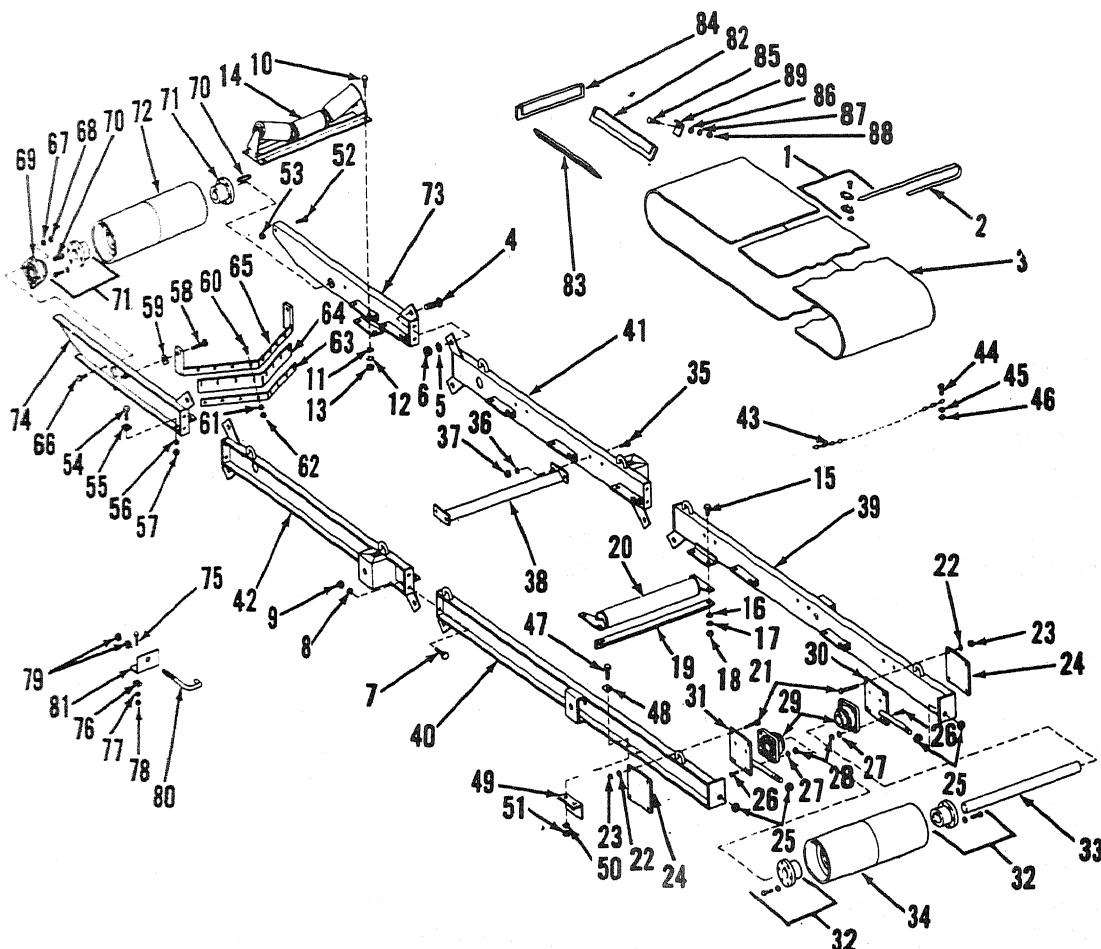
g. Bearing Reassembly. Refer to figure 33-4 and reassemble the bearing assemblies.

h. Return Roll Reassembly. Reassemble the return roll assemblies in the reverse of the numerical sequence as illustrated on figure 33-3.

i. Trough Roll Reassembly. Reassemble the trough roll assembly in the reverse of the numerical sequence as illustrated on figure 33-2.

j. Reassembly. Reassemble the rock and sand conveyors in the reverse of the numerical sequence as illustrated on figure 33-1.

k. Installation. Refer to para 24 and install the rock and sand conveyors.



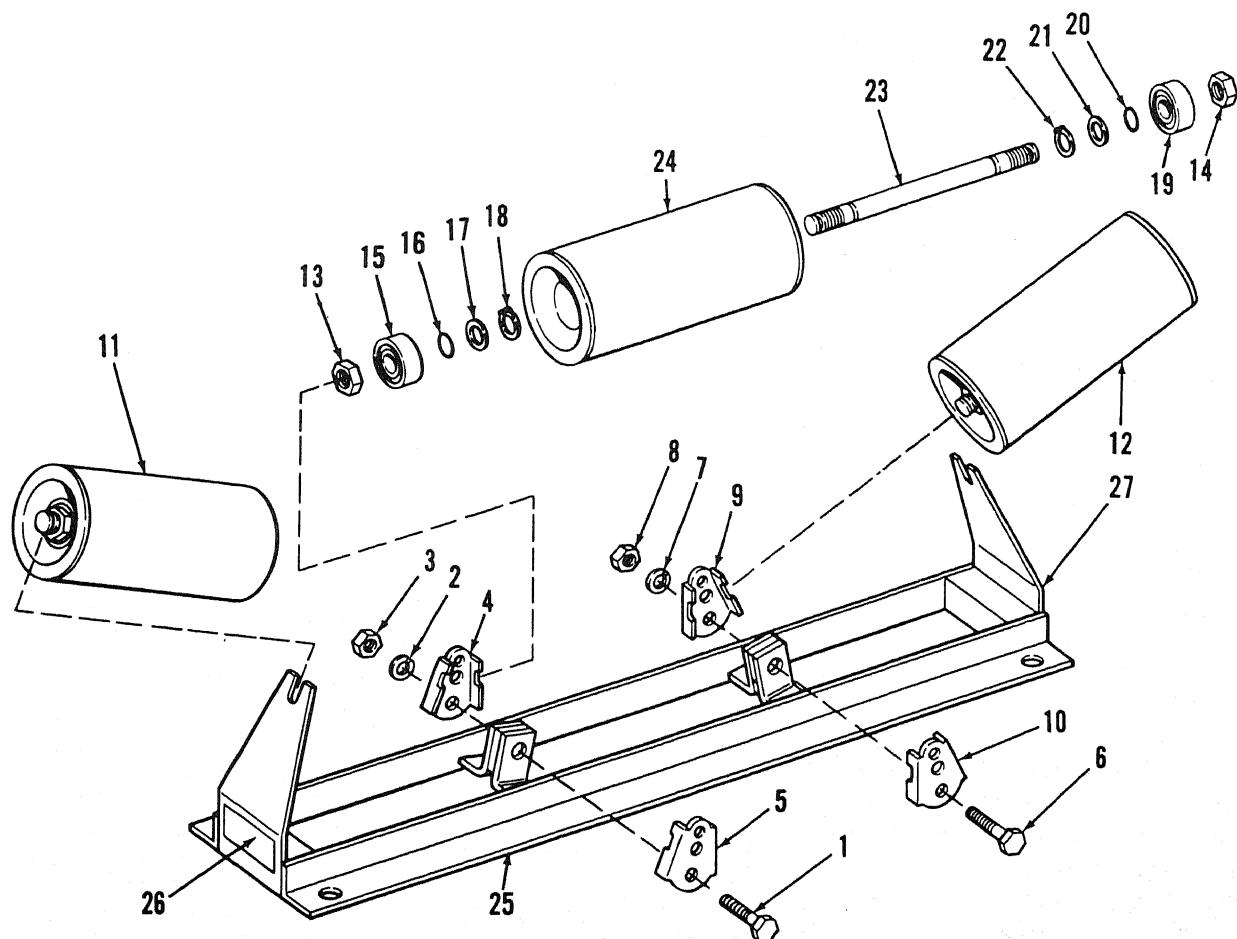
ME 3820-233-35-2/33-1

1	Belt fastener	20	Return roll assembly	39	Frame
2	Belt tape	21	Capscrew	40	Frame
3	Belt	22	Lockwasher	41	Frame
4	Capscrew	23	Nut	42	Frame
5	Lockwasher	24	Clamp	43	Chain
6	Nut	25	Nut	44	Capscrew
7	Capscrew	26	Capscrew	45	Washer
8	Lockwasher	27	Lockwasher	46	Nut
9	Nut	28	Nut	47	Capscrew
10	Capscrew	29	Bearing assembly	48	Bevel washer
11	Washer	30	Plate	49	Angle
12	Lockwasher	31	Plate	50	Lockwasher
13	Nut	32	Bushing	51	Nut
14	Trough roll assembly	33	Shaft	52	Capscrew
15	Capscrew	34	Pulley	53	Nut
16	Washer	35	Capscrew	54	Capscrew
17	Lockwasher	36	Lockwasher	55	Bevel washer
18	Nut	37	Nut	56	Lockwasher
19	Scraper	38	Spreader	57	Nut

Figure 33-1. Rock and sand conveyor, exploded view.

58	Capscrew	69	Bearing assembly	80	Bolt
59	Washer	70	Key	81	Angle
60	Bolt	71	Bushing	82	Flashing
61	Lockwasher	72	Pulley	83	Flashing
62	Nut	73	Frame	84	Flashing
63	Clamp	74	Frame	85	Bolt
64	Flashing	75	Capscrew	86	Washer
65	Frame	76	Bevel washer	87	Lockwasher
66	Capscrew	77	Lockwasher	88	Nut
67	Lockwasher	78	Nut	89	Clamp
68	Nut	79	Nut		

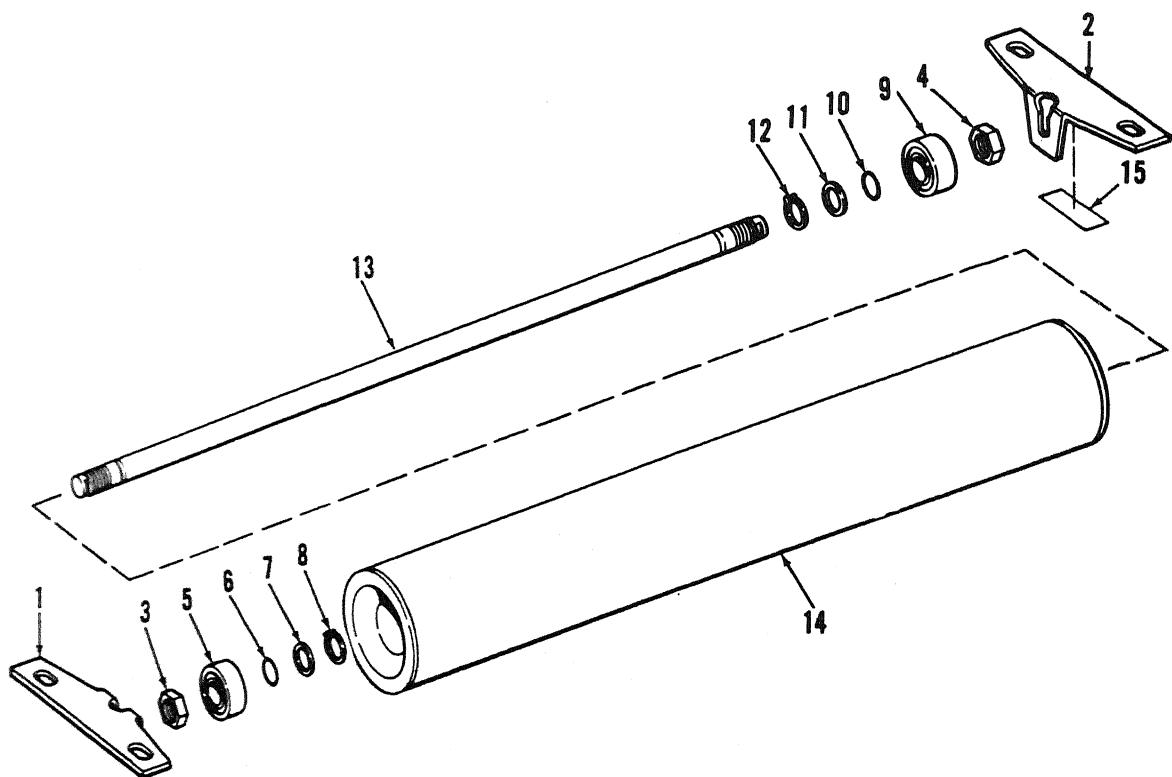
Figure 33-1—Continued



ME 3820-233-35-2/33-2

1	Capscrew	8	Nut	15	Bearing	22	Snap ring
2	Lockwasher	9	Clamp	16	O-ring	23	Shaft
3	Nut	10	Clamp	17	Washer	24	Shell, troughing roll
4	Clamp	11	Shell, troughing roll	18	Snap ring	25	Stand, troughing roll
5	Clamp	12	Shell, troughing roll	19	Bearing	26	Decal L.H.
6	Capscrew	13	Nut	20	O-ring	27	Decal R.H.
7	Lockwasher	14	Nut	21	Washer		

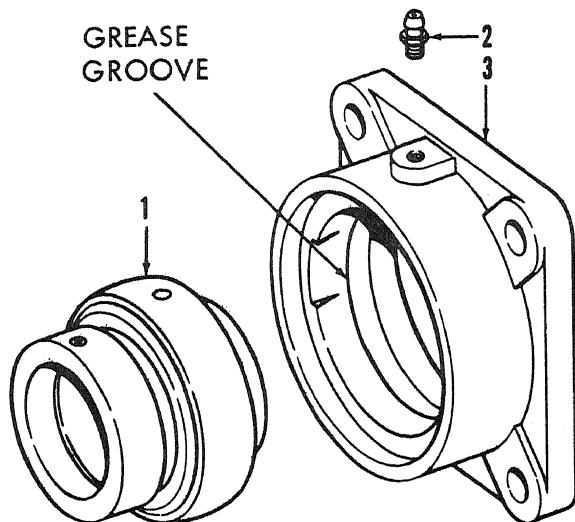
Figure 33-2. Trough roll assembly, exploded view.



ME 3820-233-35-2/33-3

1	Hanger	6	O-Ring	11	Washer
2	Hanger	7	Washer	12	Snap ring
3	Nut	8	Snap ring	13	Shaft
4	Nut	9	Bearing	14	Shell return roll
5	Bearing	10	O-Ring	15	Decal

Figure 33-3. Return roll assembly, exploded view.



ME 3820-233-35-2/33-4

- 1 Bearing
- 2 Fitting
- 3 Housing

Figure 33-4. Bearing assembly, exploded view.

Section II. OVERHEAD CONVEYOR

57. General

The overhead conveyor is located on top of the plant and consists of three sections. The overhead conveyor receives the aggregate from the primary plant and conveys it to the vibrating screen. The left and right hand head pulley bearing assemblies are similar in construction and maintenance procedures.

a. *Removal.* Refer to para 25 and remove the overhead conveyor.

b. *Disassembly.* Disassemble the overhead conveyor in the numerical sequence as illustrated on figure 34-1.

c. *Head Pulley Bearing Disassembly.* Disassemble bearing assemblies (79 and 80, fig. 34-1) as illustrated on figure 34-3.

d. *Trough Roll Disassembly.* Refer to para 56.

e. *Return Roll Disassembly.* Refer to para 56.

f. *Impact Roll Disassembly.* Disassemble the impact roll assembly as illustrated on figure 34-2.

g. *Tail Pulley Bearing Disassembly.* Refer to figure 33-4.

h. Cleaning, Inspection, and Repair

(1) Clean all parts in an approved cleaning solvent and dry thoroughly.

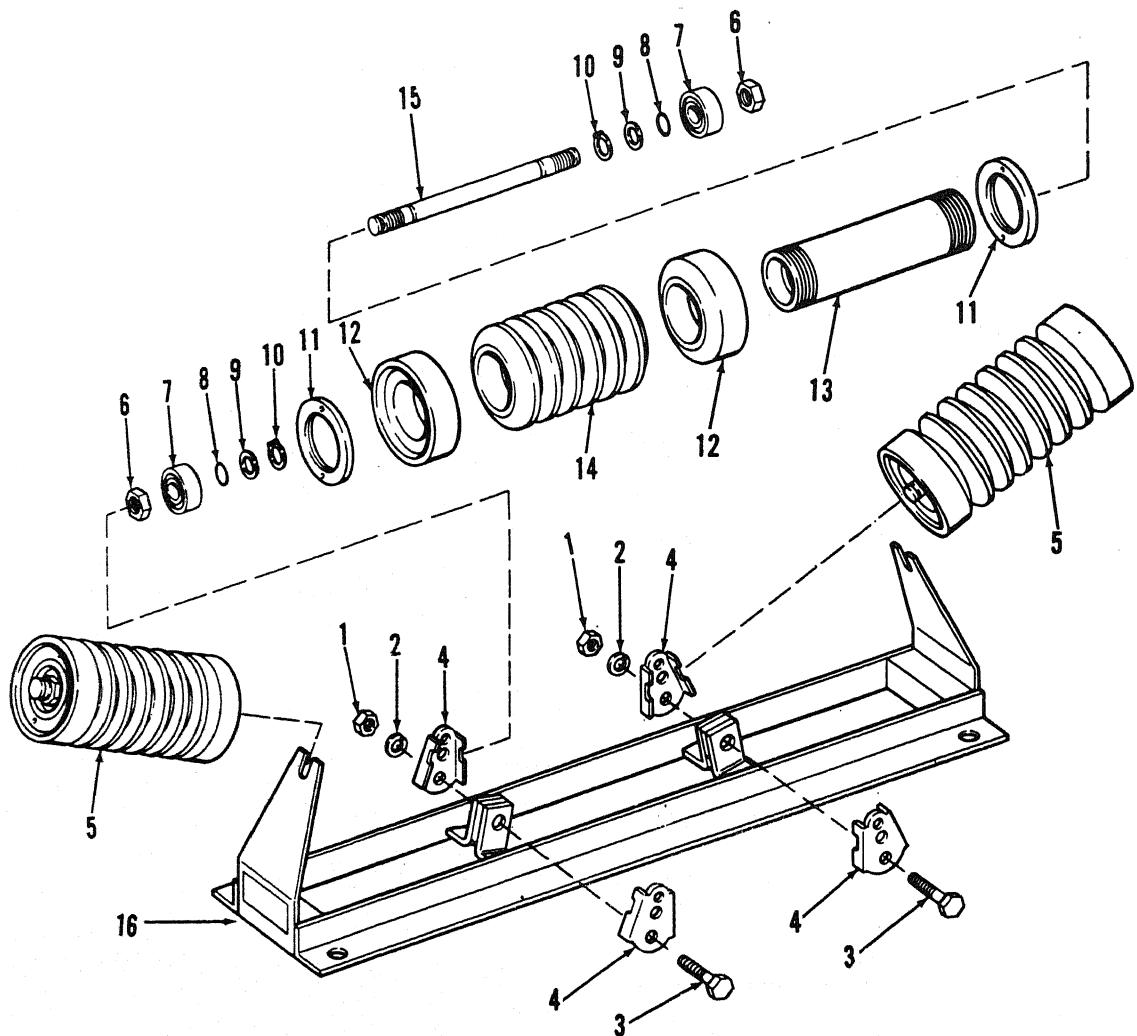
(2) Inspect conveyor frames for serious damage. Repair or replace a damaged frame.

(3) Inspect pulleys for dents, cracks and other damage. Repair or replace damaged pulley.

(4) Inspect bearings for scoring, pitting, and binding. Replace a defective bearing.

(5) Inspect skirtboards and flashing for wear and damage, and replace if necessary.

Figure 34-1. Overhead conveyor, exploded view.
Located in back of manual.



ME 3820-233-35-2/34-2

1 Nut	7 Bearing	13 Shell
2 Lockwasher	8 Packing, preformed	14 Center disc
3 Capscrew	9 Washer	15 Shaft
4 Clamp	10 Retainer	16 Stand
5 Roll and shaft assembly	11 Collar	
6 Nut	12 End disc	

Figure 34-2. Impact roll assembly, exploded view.

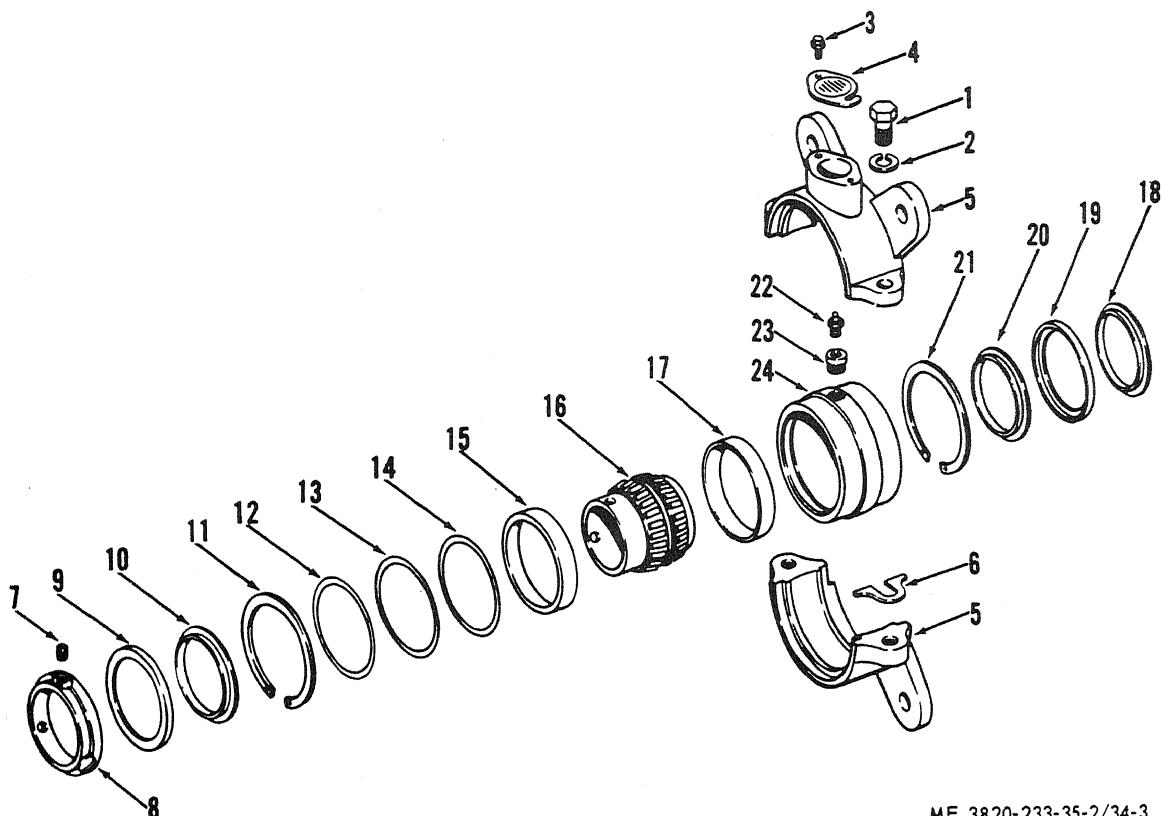
(6) Inspect conveyor belts for wear and fraying. Replace a worn or defective belt.

(7) Inspect trough and return roll assemblies to make sure they turn freely. Replace defective component parts or the whole assembly as required.

(8) Inspect the hopper for serious damage, and repair or replace hopper as necessary.

(9) Inspect the hopper lines for wear and damage, and replace if necessary.

(10) Inspect all parts and replace defective parts.



ME 3820-233-35-2/34-3

1	Capscrew	9	Seal	17	Bearing cup
2	Lockwasher	10	Seal	18	Seal
3	Screw	11	Retainer ring	19	Seal
4	Identification plate	12	Shim	20	Seal
5	Housing	13	Shim	21	Retainer ring
6	Shim	14	Shim	22	Fitting
7	Setscrew	15	Bearing cup	23	Stud
8	Collar	16	Bearing cone	24	Inner housing

Figure 34-3. Head pulley bearing assembly.

i. *Tail Pulley Bearing Reassembly.* Refer to figure 33-4 and reassemble the tail bearing assembly.

j. *Impact Roll Reassembly.* Refer to figure 34-2 and reassemble the impact roll assembly.

k. *Return Roll Reassembly.* Reassemble the return roll assembly in the reverse of the numerical sequence as illustrated on figure 33-3.

l. *Trough Roll Reassembly.* Reassemble the trough roll assembly in the reverse of the

numerical sequence as illustrated on figure 33-2.

m. *Head Pulley Bearing Reassembly.* Refer to figure 34-3 and reassemble head pulley bearing assemblies.

n. *Reassembly.* Reassemble the overhead conveyor in the reverse of the numerical sequence as illustrated on figure 34-1.

o. *Installation.* Refer to para 25 and install the overhead conveyor.

Section III. ROCK AND SAND CONVEYOR DRIVES

58. General

The rock and sand conveyor drive components are similar in construction and maintenance procedures. A gear box, countershaft, and speed reducer are the major components in the drive assembly. The rock and sand conveyor drive assemblies are belt driven and controlled by twin disc clutch assemblies located on both ends of the screen and side conveyor countershaft.

59. Sand Conveyor Drive

a. Removal and Disassembly

(1) Remove the main countershaft-to-lower countershaft guard, and the lower countershaft-to-sand conveyor drive guard.

(2) The sand conveyor drive is shown installed on figure 35-1. Remove and disassemble the sand conveyor drive in the numerical sequence as illustrated on figure 35-2.

b. Speed Reducer Disassembly

(1) Drain lubricant from speed reducer.

(2) Disassemble speed reducer in the numerical sequence as illustrated on figure 35-3.

c. Bearing Disassembly. Disassemble the bearing assembly as illustrated on figure 35-4.

d. Gear Box Disassembly

(1) Drain lubricant from gear box.

(2) Disassemble gear box in the numerical sequence as illustrated on figure 35-5. Insert or remove shims (8A, 8B, and 8C) or (24A, 24B, 24C) until a slight clearance of .006 to .008 inch is obtained between gear and pinion. Clearance can be determined by holding one shaft and rotating the other shaft.

Note. Install grease seals so knife edge of seals contacting the revolving shaft and coupling is turned in toward center of gear box.

e. Cleaning, Inspection, and Repair

(1) Clean all parts in an approved cleaning solvent and dry thoroughly.

(2) Inspect the coupling chain for broken links. Replace damaged links as necessary.

(3) Inspect all oil seals for burrs or nicks. Replace a defective seal.

(4) Inspect all bearings for wear, scoring, or pitting. Replace a defective bearing.

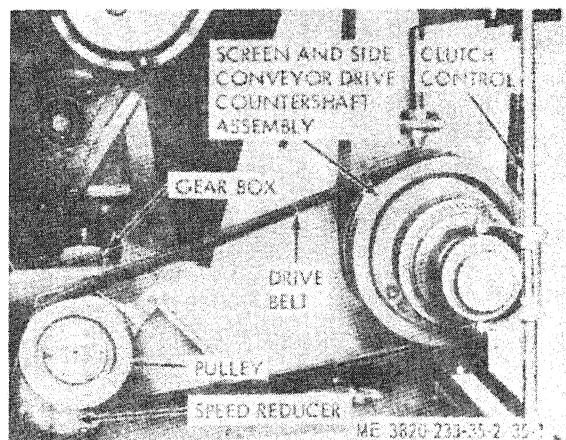


Figure 35-1. Sand conveyor drive, removal and installation.

(5) Perform a magnetic inspection of all gears and shafts. Inspect gear teeth for wear, pitting, chipping, nicks, cracks, or scoring. Replace defective parts.

(6) Inspect shafts for wear or bent condition. Inspect splined shafts for twisted splines. Replace a defective shaft.

(7) Inspect the speed reducer output hub for wear, burrs, or nicks. Replace a defective hub.

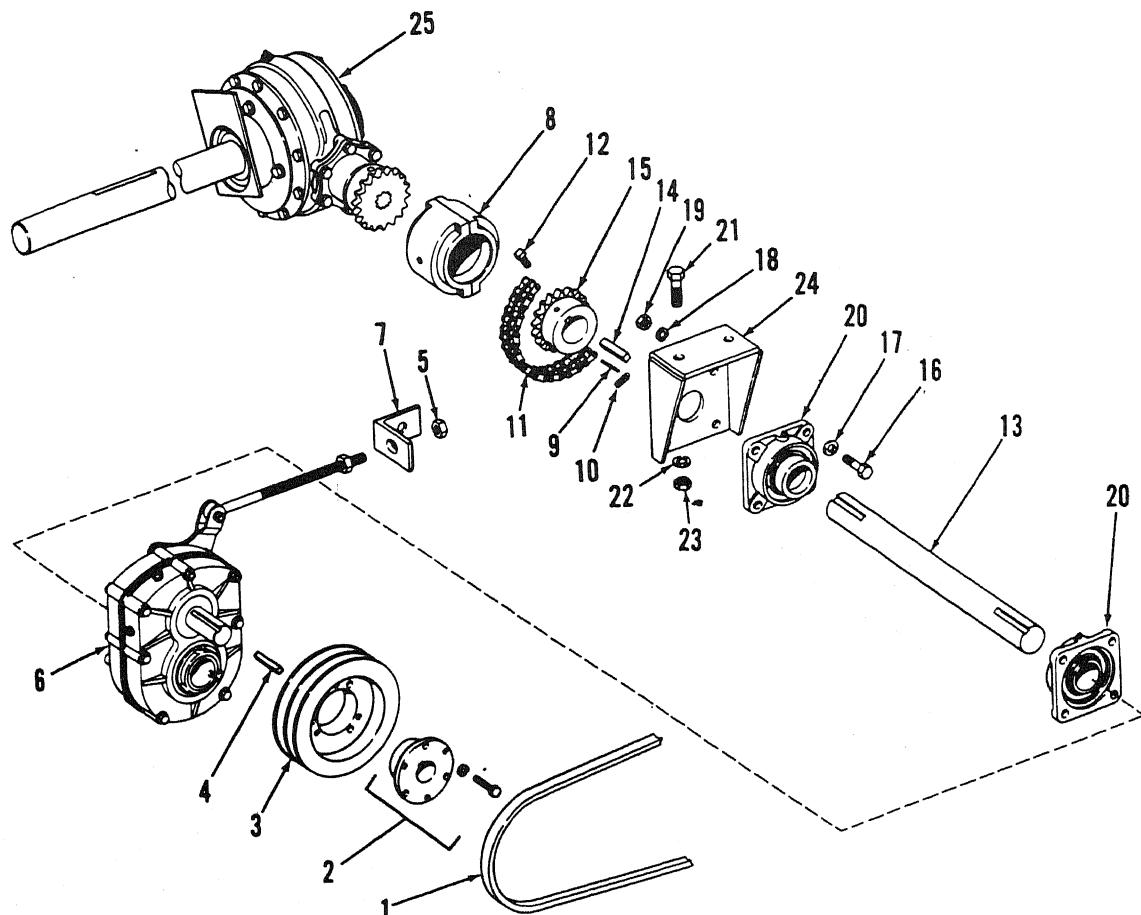
(8) Inspect all housings and covers to see that mating surfaces, and housing bores are free from nicks or burrs. Inspect for cracks or breaks. Repair or replace defective parts.

(9) Replace all gaskets.

(10) Thoroughly inspect all parts for wear or damage. Replace defective parts as necessary.

f. Gear Box Reassembly.

(1) Reassemble gear box in the reverse of the numerical sequence as illustrated on figure 35-5. Insert or remove shims (8A, 8B, and 8C) or (24A, 24B, and 24C) until a slight clearance of .006 to .008 inch is obtained between gear and pinion. Clearance can be determined by holding one shaft and rotating the other shaft.



ME 3820-233-35-2/35-2

1	V-Belt	10	Clip	19	Nut
2	Bushing	11	Chain	20	Bearing assembly
3	Pulley	12	Setscrew	21	Capscrew
4	Key	13	Shaft	22	Lockwasher
5	Nut	14	Key	23	Nut
6	Speed reducer	15	Coupling	24	Support
7	Support	16	Capscrew	25	Gear box
8	Coupling	17	Washer		
9	Pin	18	Lockwasher		

Figure 35-2. Sand conveyor drive, exploded view.

Note. Install grease seals so knife edge of the seals contacting revolving shaft and coupling is turned in toward center of gear box.

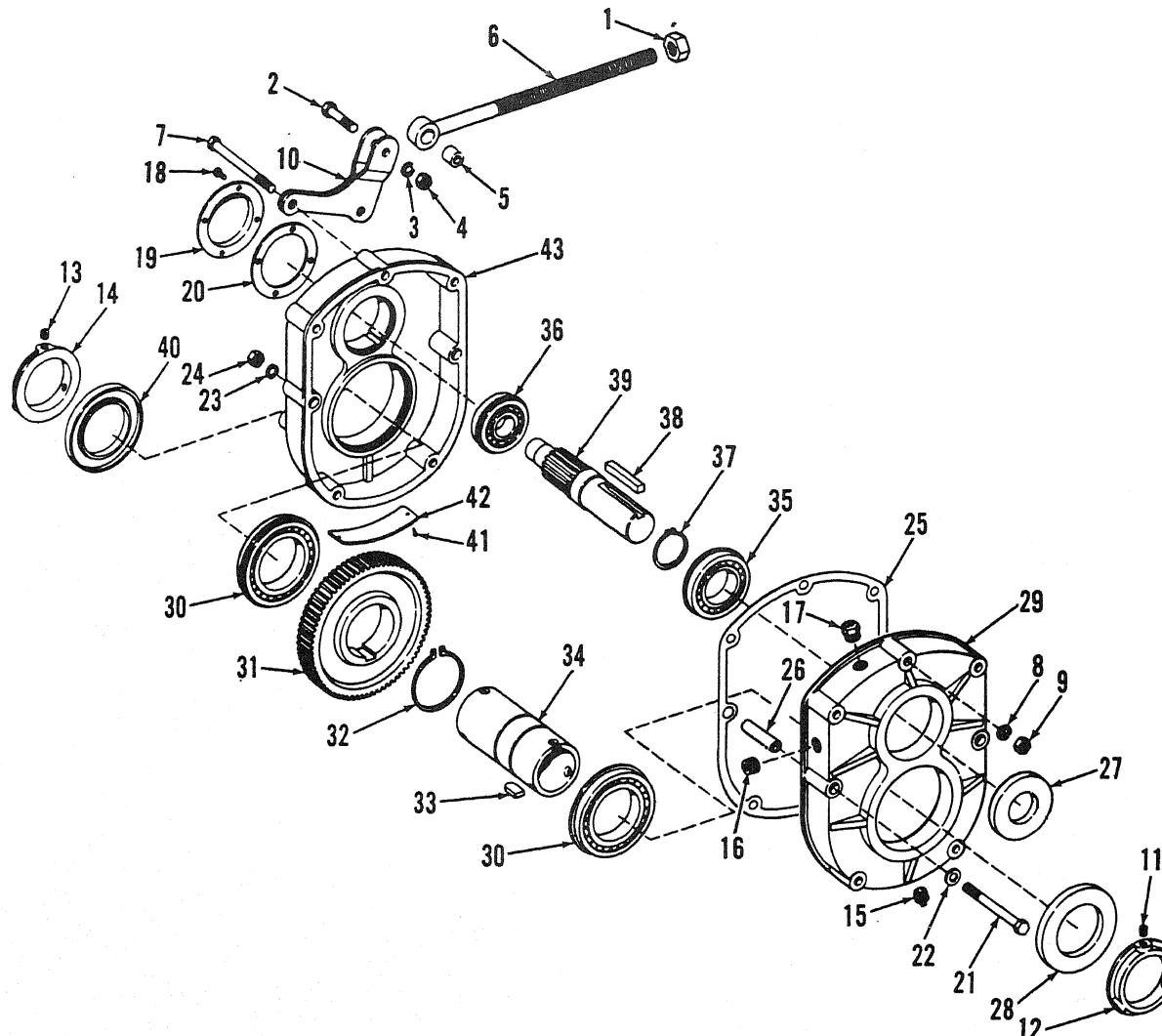
(2) Fill gear box with lubricant (Operator's Manual).

g. **Bearing Reassembly.** Reassemble the assembly as illustrated on figure 35-4.

h. Speed Reducer Reassembly.

(1) Reassemble speed reducer in the reverse of the numerical sequence as illustrated on figure 35-3. Follow the instructions below when installing gears and bearings.

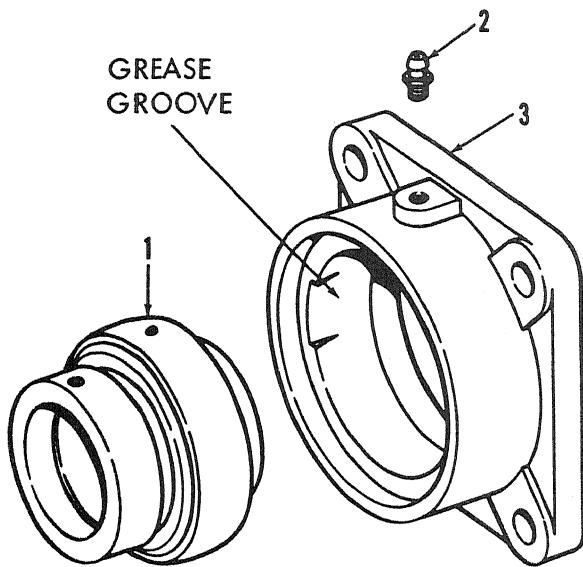
(a) Heat gear (31) in oil (325°F—350°F) to shrink onto hub (34).



ME 3820-233-35-2/35-3

1 Nut	12 Collar	23 Lockwasher	34 Hub
2 Bolt	13 Screw	24 Nut	35 Bearing
3 Lockwasher	14 Collar	25 Gasket	36 Bearing
4 Nut	15 Plug	26 Dowel pin	37 Snap ring
5 Bushing	16 Plug	27 Seal	38 Key
6 Rod	17 Plug	28 Seal	39 Shaft
7 Bolt	18 Screw	29 Housing	40 Seal
8 Lockwasher	19 Cover	30 Bearing	41 Screw
9 Nut	20 Gasket	31 Gear	42 Identification plate
10 Adapter	21 Bolt	32 Snap ring	43 Housing
11 Screw	22 Washer	33 Key	

Figure 35-3. Speed reducer, exploded view.



ME 3820-233-35-2/35-4

1 Bearing 2 Fitting 3 Housing

Figure 35-4. Bearing assembly, exploded view.

(b) Heat bearings (30) in oil (270°F—290°F) to shrink onto hub (34).

Caution: Any injury to the hub surfaces where the oil seals (28 and 40) rub will cause leakage, and a new hub will have to be installed.

Note. When pressing bearings (35 and 36) on shaft (39), press against the inner race, not the outer race, of the bearings.

(2) Fill cavity between the oil seals and housing bores with chassis grease to prevent oil leakage.

(3) Fill speed reducer with lubricant (Operator's Manual).

i. Installation and Reassembly

(1) Reassemble and install sand conveyor drive in the reverse of the numerical sequence as illustrated on figures 35-1 and 35-2.

(2) Refer to the Operator's Manual and make the necessary belt tension adjustments.

(3) Install the main countershaft-to-lower countershaft guard, and the lower countershaft-to-sand conveyor drive guard.

60. Rock Conveyor Drive

The rock conveyor drive is shown installed on figure 36-1. Remove, disassemble, repair, reassemble, and install the rock conveyor drive (fig. 36-2) in the same manner as discussed under "Sand Conveyor Drive". Refer to the Operator's Manual and remove the screen and screen countershaft guard, and the idler-to-rock conveyor drive guard. Be sure to install guards after installation and reassembly.

61. Screen and Side Conveyor Countershaft Drive

a. Removal and Disassembly.

(1) Remove the main countershaft-to-lower countershaft guard, and the screen and screen countershaft guard (Operator's Manual).

(2) Remove the clutch controls and twin-disc clutch assembly (Operator's Manual).

(3) Remove and disassemble the screen and side conveyor countershaft drive assembly as illustrated on figure 37-1.

b. Twin-Disc Clutch Disassembly. Disassemble the twin-disc clutch assemblies in the numerical sequence as illustrated on figure 37-2.

c. Bearing Disassembly. Bearing assemblies (82 and 104, fig. 37-1) are identical to those illustrated on figure 34-3.

d. Cleaning, Inspection, and Repair.

(1) Clean all parts in an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for wear and damage. Replace or repair all defective parts.

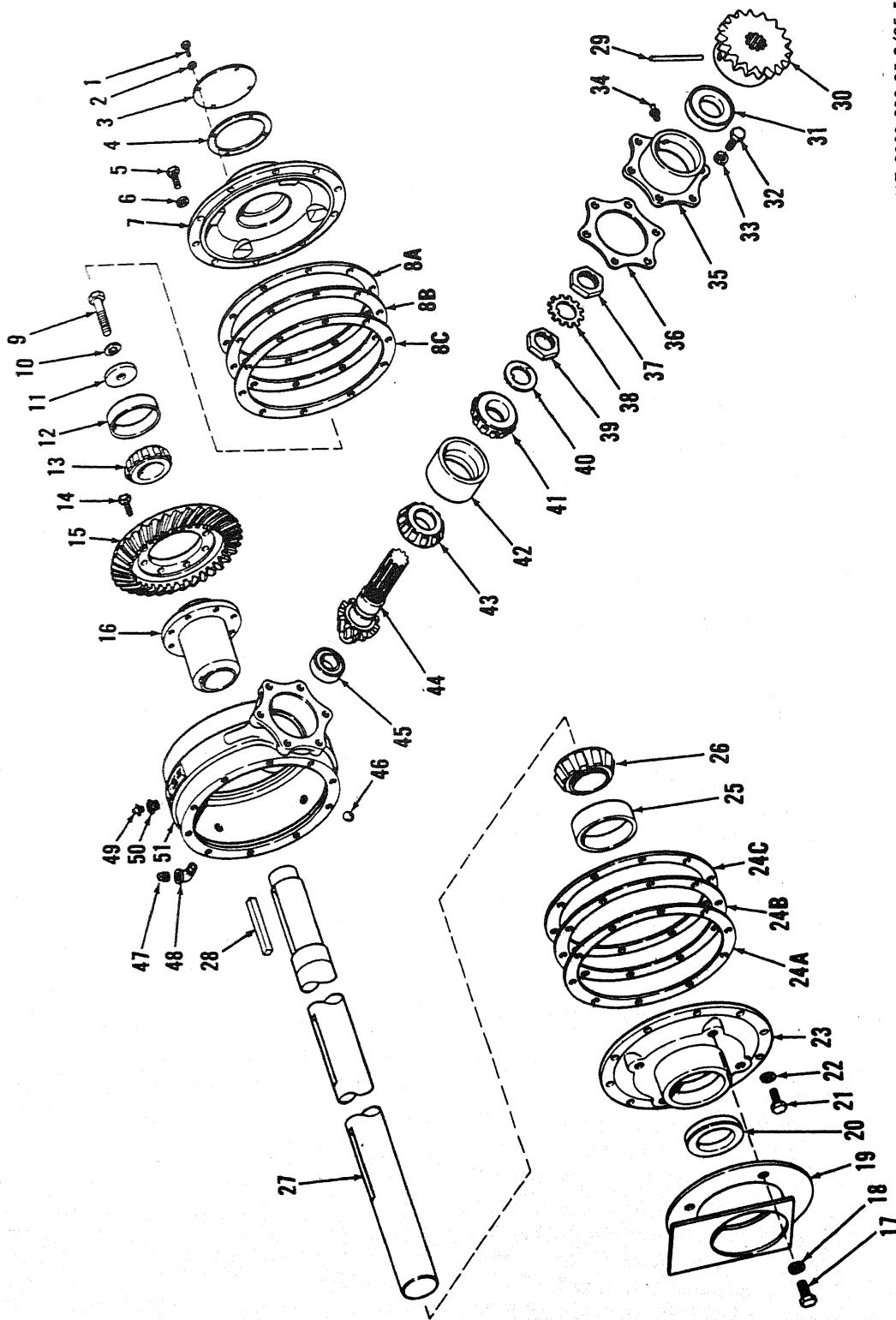
e. Bearing Reassembly. Reassemble bearing assemblies as illustrated on figure 34-3.

f. Twin-Disc Clutch Reassembly. Reassemble the twin-disc clutch assembly in the reverse of the numerical sequence as illustrated on figure 37-2.

g. Reassembly and Installation.

(1) Reassemble and install the screen and side conveyor countershaft drive assembly as illustrated on figure 37-1.

(2) Install the twin-disc clutch assembly and clutch controls (Operator's Manual).

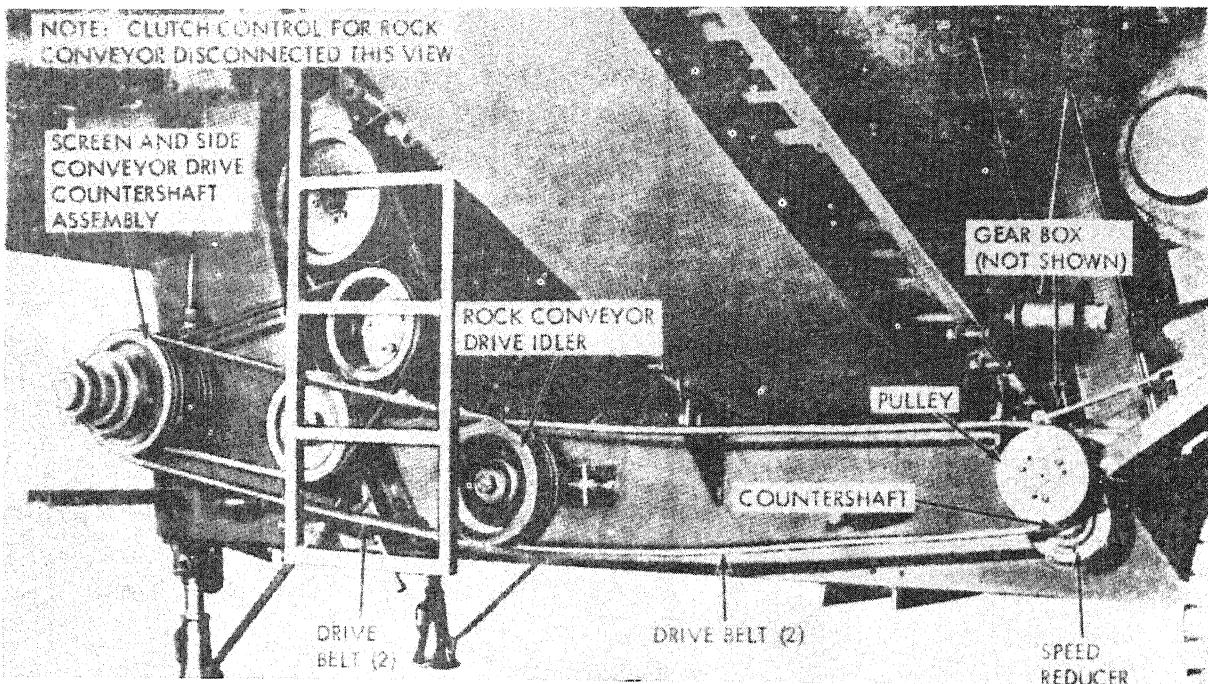


ME 3820-233-35-2/35-5

Figure 35-5. Gear box assembly, exploded view.

1	Capscrew	18	Lockwasher
2	Lockwasher	19	Plate
3	Plate	20	Seal
4	Gasket	21	Capscrew
5	Capscrew	22	Lockwasher
6	Lockwasher	23	Cover
7	Cover	24A	Shim
8A	Shim	24B	Shim
8B	Shim	24C	Shim
8C	Shim	25	Bearing cup
9	Capscrew	26	Bearing cone
10	Washer	27	Shaft
11	Washer	28	Key
12	Bearing cup	29	Rivet
13	Bearing cone	30	Sprocket
14	Capscrew	31	Seal
15	Gear	32	Capscrew
16	Flange	33	Lockwasher
17	Capscrew	34	Fitting
			Retainer
			Gasket
			Nut
			Washer
			Nut
			Washer
			Bearing cone
			Bearing cup
			Bearing cone
			Pinion and shaft
			Bearing
			Plug
			Plug
			Elbow
			Breather
			Bushing
			Housing

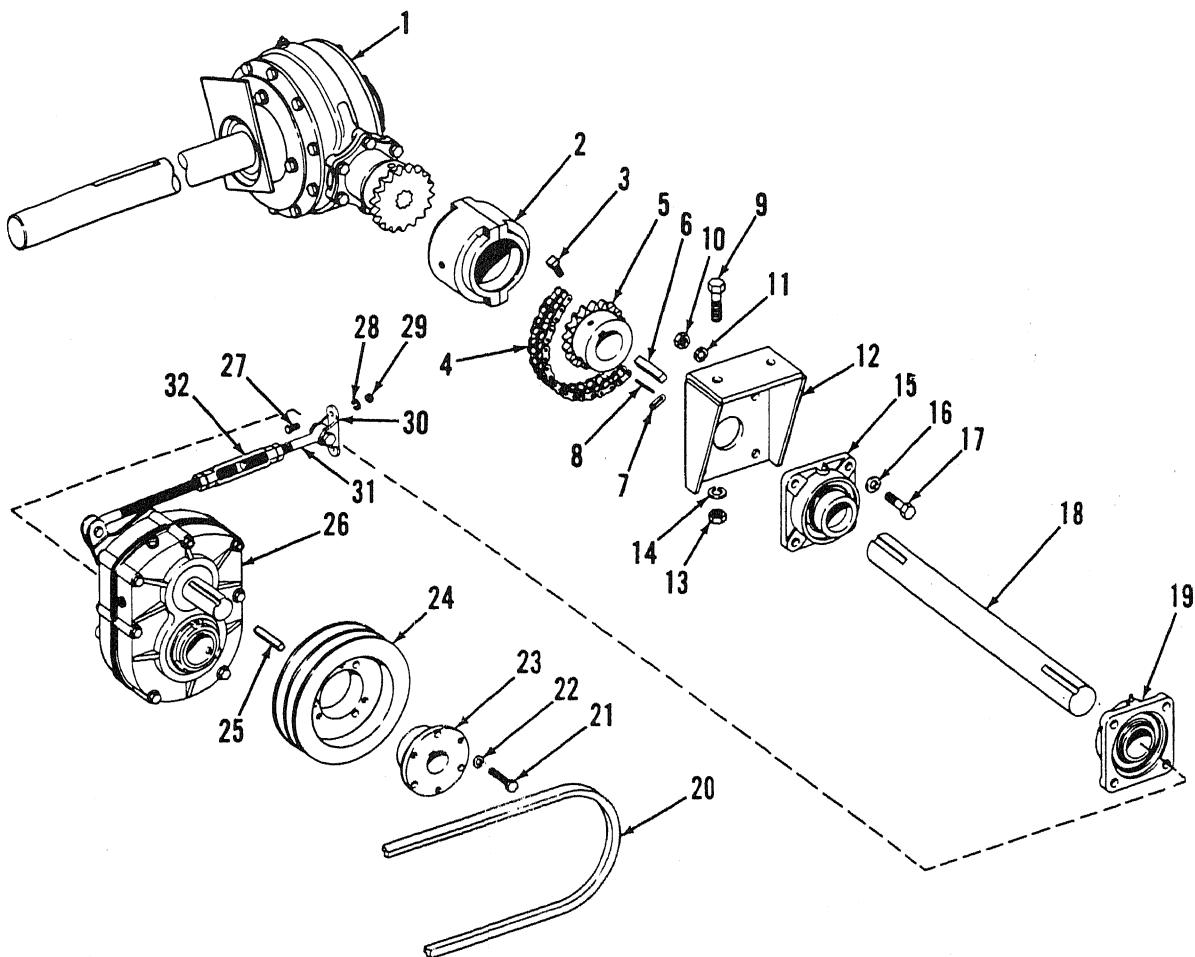
Figure 35-5—Continued



ME 3820-233-35-2 36-1

Figure 36-1. Rock conveyor drive, removal and installation.

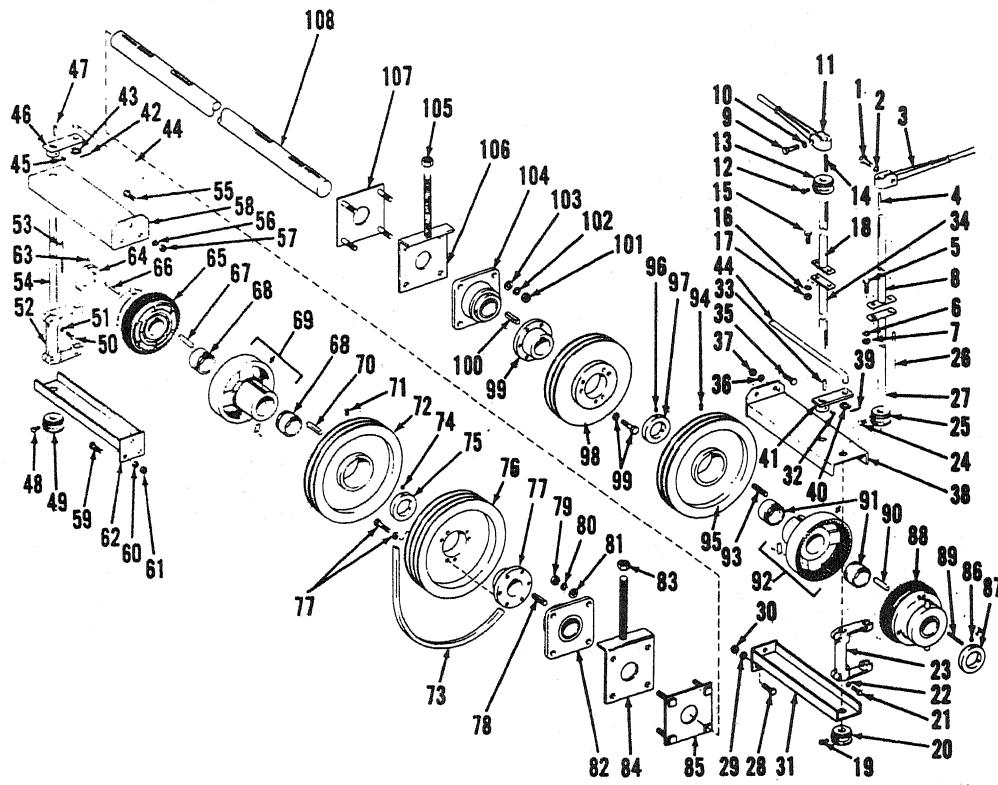
- (3) Adjust for correct belt tension (Operator's Manual).
- (4) Adjust the twin-disc clutch (Operator's Manual).
- (5) Install the main countershaft-to-lower countershaft guard, and the screen countershaft guard (Operator's Manual).



ME 3820-233-35-2/36-2

1 Gear Box	12 Support	23 Bushing
2 Guard	13 Nut	24 Pulley
3 Capscrew	14 Lockwasher	25 Key
4 Chain	15 Bearing	26 Gear Box
5 Sprocket	16 Washer	27 Capscrew
6 Key	17 Capscrew	28 Lockwasher
7 Link	18 Shaft	29 Nut
8 Pin	19 Bearing	30 Fulcrum
9 Capscrew	20 Belt	31 Extension
10 Nut	21 Capscrew	32 Turn buckle
11 Lockwasher	22 Lockwasher	

Figure 36-2. Rock conveyor drive, exploded view.



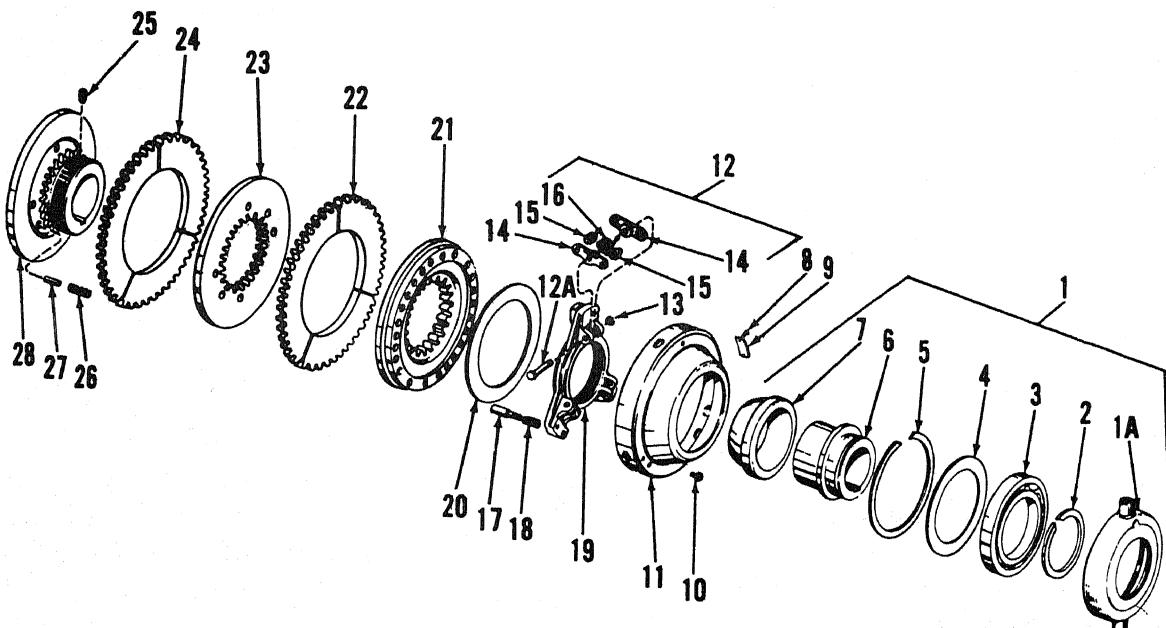
ME 3820-233-35-2/37-1

1	Screw	19	Setscrew	37	Nut
2	Lockwasher	20	Collar	38	Support
3	Lever	21	Capscrew	39	Pin
4	Key	22	Lockwasher	40	Washer
5	Capscrew	23	Yoke	41	Arm
6	Lockwasher	24	Setscrew	42	Pin
7	Nut	25	Collar	43	Washer
8	Lever shaft	26	Key	44	Rod
9	Capscrew	27	Shaft	45	Setscrew
10	Lockwasher	28	Capscrew	46	Arm
11	Lever	29	Lockwasher	47	Key
12	Setscrew	30	Nut	48	Setscrew
13	Collar	31	Support	49	Collar
14	Key	32	Setscrew	50	Capscrew
15	Capscrew	33	Key	51	Lockwasher
16	Lockwasher	34	Shaft	52	Yoke
17	Nut	35	Capscrew	53	Key
18	Shaft	36	Lockwasher	54	Yoke shaft

Figure 37-1. Screen and side conveyor drive countershaft assembly and clutch controls, exploded view.

55	Capscrew	73	V-Belt	91	Bushing
56	Lockwasher	74	Setscrew	92	Spider
57	Nut	75	Collar	93	Key
58	Support	76	Pulley	94	Setscrew
59	Capscrew	77	Bushing	95	Pulley
60	Lockwasher	78	Key	96	Setscrew
61	Nut	79	Nut	97	Collar
62	Support	80	Lockwasher	98	Pulley
63	Setscrew	81	Washer	99	Bushing
64	Collar	82	Bearing assembly	100	Key
65	Clutch assembly	83	Nut	101	Nut
66	Key	84	Plate	102	Lockwasher
67	Key	85	Plate	103	Washer
68	Bushing	86	Setscrew	104	Bearing assembly
69	Spider	87	Collar	105	Nut
70	Key	88	Clutch assembly	106	Plate
71	Setscrew	89	Key	107	Plate
72	Pulley	90	Key	108	Countershaft

Figure 37-1—Continued



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1	Cone assembly (Incl. items 1 through 7)	10	Screw	19	Yoke
1A	Collar	11	Cover	20	Disc
2	Snap ring	12	Yoke assembly (Incl. items 12A through 19)	21	Floating plate
3	Bearing	12A	Lever pin	22	Driving plate
4	Washer	13	Cotter pin	23	Center plate
5	Snap ring	14	Lever	24	Driving plate
6	Sleeve	15	Roller	25	Setscrew
7	Ring	16	Lever spring	26	Release spring
8	Drive pin	17	Lock pin	27	Pin
9	Identification plate	18	Spring	28	Hub and back plate

Figure 37-2. Twin-disc clutch assembly, exploded view.

Section IV. OVERHEAD CONVEYOR DRIVE

62. General

The drive arrangement for the overhead conveyor is from the main countershaft by V-belts to a shaft mounted torque arm speed reducer located on the head pulley shaft.

63. Overhead Conveyor Drive

a. Removal.

(1) Remove the main countershaft-to-overhead conveyor drive guard (Operator's Manual).

(2) Remove the conveyor drive belts (Operator's Manual).

(3) Disconnect torque arm from support (fig. 38-1).

(4) Loosen setscrews in both collars and remove outside collar from shaft (fig. 38-1).

(5) Remove the speed reducer from head pulley shaft.

b. Disassembly.

(1) Drain lubricant from speed reducer.

(2) Disassemble conveyor drive in the numerical sequence as illustrated on figure 38-2.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in an approved cleaning solvent and dry thoroughly.

(2) Inspect oil seals for burrs, or nicks. Replace a defective seal.

(3) Perform a magnetic inspection of gears, shaft, and hub. Inspect gear teeth for wear, pitting, chipping, nicks, cracks, or scoring. Replace defective parts.

(4) Inspect housings and covers to see that mating surfaces and housing bores are free from nicks or burrs. Inspect for cracks or breaks. Replace defective parts.

(5) Replace all gaskets.

(6) Thoroughly inspect all parts for extensive wear or damage. Replace defective parts as necessary.

d. Reassembly.

(1) Reassemble the conveyor drive in the

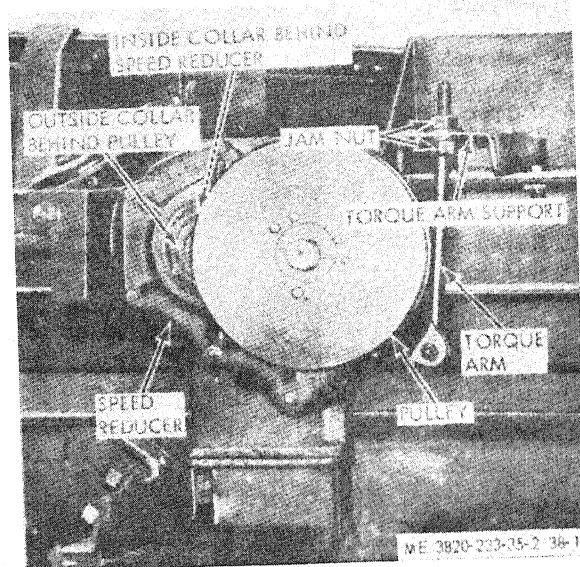


Figure 38-1. Overhead conveyor drive, removal and installation.

reverse of the numerical sequence as illustrated on figure 38-2. To install gear (51) and bearings (47), proceed as follows:

(a) Heat gear (51) in oil to 325° to 350°F to shrink onto hub (53).

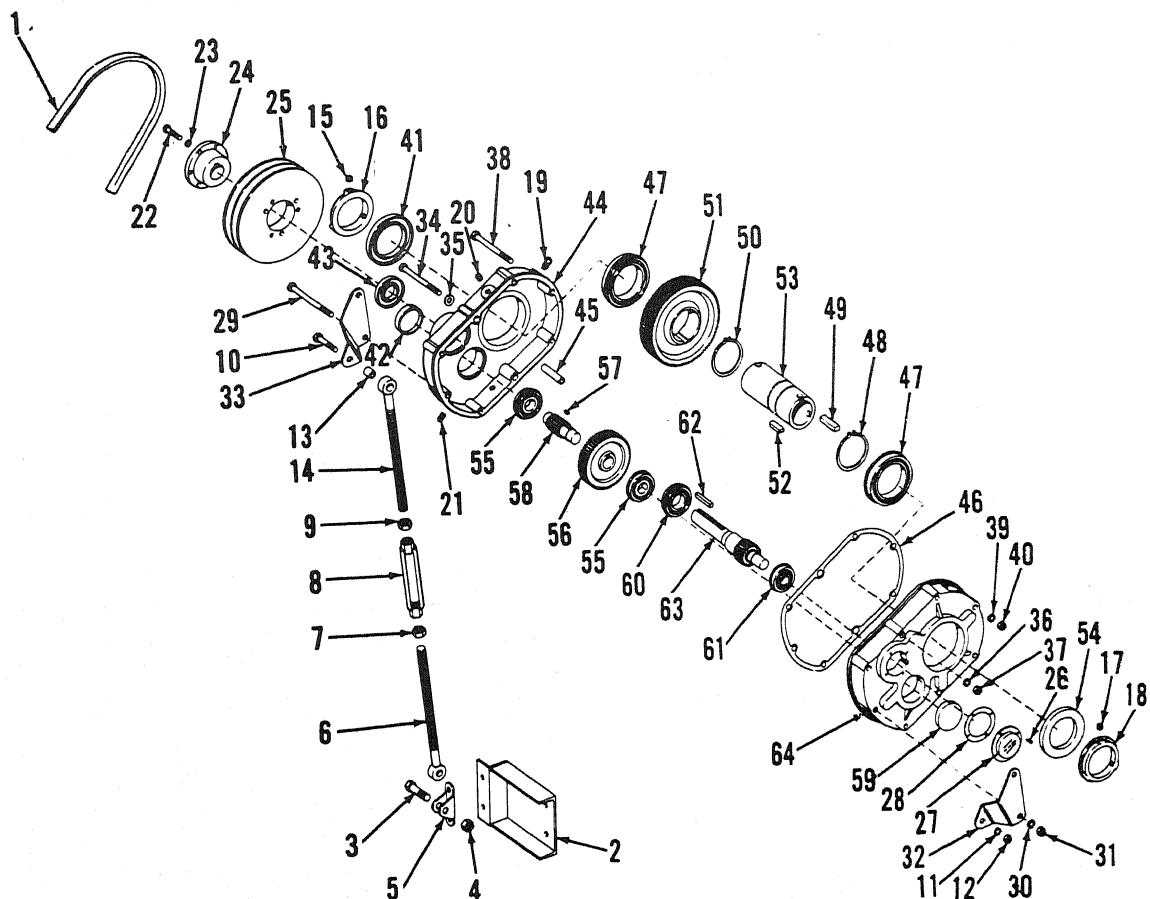
(b) Heat bearings (47) in oil to 270° to 290°F to shrink onto hub (53).

Caution: Any injury to the hub surfaces where the oil seals (41 and 54) rub, will cause leakage, and a new hub will have to be installed.

Note. When pressing bearings (55, 60, and 61) onto countershaft (58) and shaft (63), press against the inner race, not the outer race of the bearings.

(2) Fill cavity between the oil seals and housing bores with chassis grease to prevent oil leakage.

(3) Refer to the lubrication order in the Operator's Manual and fill the speed reducer with oil.



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1	V-Belt	23	Lockwasher	45	Dowel pin
2	Support	24	Bushing	46	Gasket
3	Capscrew	25	Pulley	47	Bearing
4	Nut	26	Screw	48	Snap ring
5	Bracket	27	Cover	49	Key
6	Threaded rod	28	Gasket	50	Snap ring
7	Nut	29	Bolt	51	Gear
8	Connector	30	Lockwasher	52	Key
9	Nut	31	Nut	53	Hub
10	Capscrew	32	Bracket	54	Seal
11	Lockwasher	33	Bracket	55	Bearing
12	Nut	34	Capscrew	56	Gear
13	Bushing	35	Washer	57	Key
14	Threaded rod	36	Lockwasher	58	Countershaft
15	Setscrew	37	Nut	59	Cap
16	Collar	38	Capscrew	60	Bearing
17	Setscrew	39	Lockwasher	61	Bearing
18	Collar	40	Nut	62	Key
19	Plug	41	Seal	63	Shaft
20	Plug	42	Seal	64	Housing
21	Plug	43	Seal		
22	Capscrew	44	Housing		

Figure 38-2. Overhead conveyor drive, exploded view.

e. Installation.

- (1) Install speed reducer (fig. 38-1). Tighten setscrews on inside collar securely.
- (2) Install outside collar and tighten setscrews securely.
- (3) Secure torque arm to support (fig. 38-1).

(4) Install conveyor drive belts and adjust for correct belt tension (Operator's Manual).

(5) Install the main countershaft-to-overhead conveyor drive guard (Operator's Manual).

Section V. ELEVATING WHEEL**64. General**

The elevating wheel assembly, rotated by two trunnion wheels, elevates crushed aggregate received from the undercrusher conveyor, and discharges it onto the overhead conveyor for resizing and scalping.

65. Elevating Wheel Assembly*a. Removal.*

(1) Remove the elevating wheel assembly (para 26).

(2) Remove the overhead conveyor tail frame and hopper as instructed on figure 39-1.

b. Disassembly. Disassemble the elevating wheel assembly in the numerical sequence as illustrated on figure 39-2.

Note. Remove parts 1 through 42 from the plant, and parts 43 through 134 from the elevating wheel.

c. Sprocket Idler Bearing Disassembly. Disassemble the sprocket idler bearing (6, fig. 39-2) as illustrated on figure 39-3.

d. Trunnion Bearing Disassembly. Disassemble the trunnion bearing assembly (28, fig. 39-2) as illustrated on figure 39-4.

e. Cleaning, Inspection, and Repair.

(1) Clean all parts in an approved cleaning solvent and dry thoroughly.

(2) Inspect all parts for excessive wear. Replace or repair defective parts.

f. Trunnion Bearing Reassembly. Reassemble the trunnion bearing assembly as illustrated on figure 39-4.

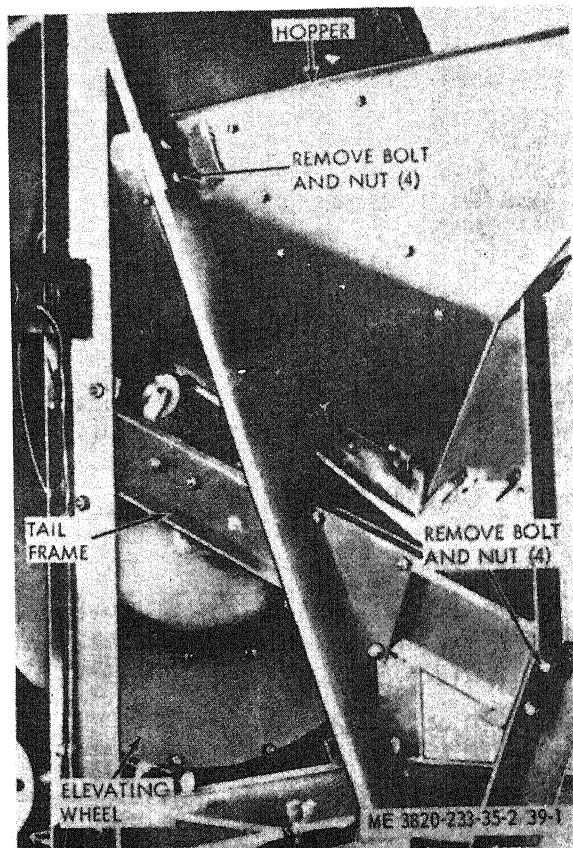


Figure 39-1. Conveyor tail frame and hopper, removal and installation.

g. Sprocket Idler Bearing Reassembly. Reassemble the sprocket idler bearing assembly as illustrated on figure 39-3.

h. Reassembly. Reassemble the elevating wheel in the reverse of the numerical sequence as illustrated on figure 39-2.

Note. Assemble parts 1 through 42 to the lant, and 43 through 134 to the elevating wheel.

i. Installation.

(1) Refer to figure 39-1 and install the

conveyor tail frame and hopper to the elevating wheel assembly.

(2) Install the elevating wheel assembly (para 24).

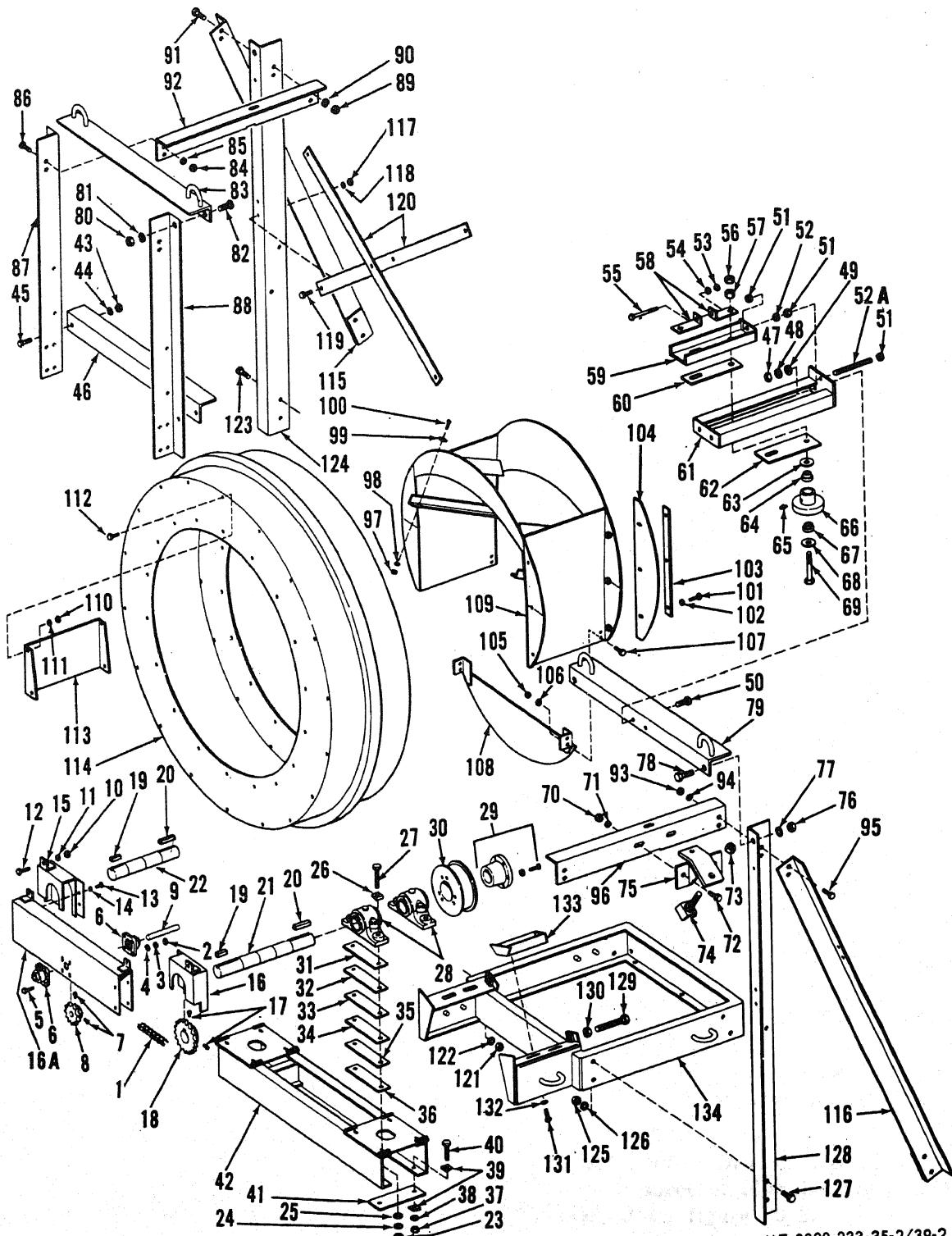
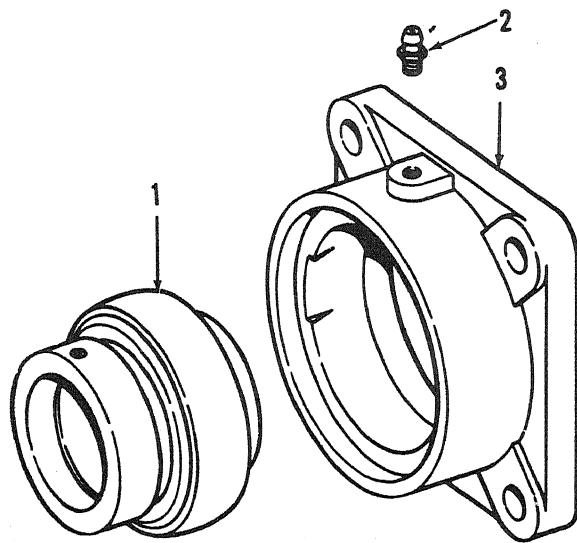


Figure 39-2. Elevating wheel assembly, exploded view.

1	Chain	46	Frame tie	90	Lockwasher
2	Nut	47	Nut	91	Capscrew
3	Lockwasher	48	Lockwasher	92	Spreader
4	Washer	49	Washer	93	Nut
5	Capscrew	50	Capscrew	94	Lockwasher
6	Bearing assembly	51	Nut	95	Capscrew
7	Setscrew	52	Nut	96	Spreader
8	Sprocket	52A	Stud	97	Nut
9	Shaft	53	Nut	98	Lockwasher
10	Nut	54	Nut	99	Bevel washer
11	Lockwasher	55	Capscrew	100	Capscrew
12	Capscrew	56	Nut	101	Capscrew
13	Capscrew	57	Nut	102	Lockwasher
14	Lockwasher	58	Bracket	103	Clamp
15	Guard	59	Plate	104	Flashing
16	Guard	60	Plate	105	Nut
16A	Guard	61	Support	106	Lockwasher
17	Setscrew	62	Plate	107	Capscrew
18	Sprocket	63	Washer	108	Baffle
19	Key	64	Bearing	109	Hopper
20	Key	65	Fitting	110	Nut
21	Shaft	66	Wheel	111	Lockwasher
22	Shaft	67	Fitting	112	Capscrew
23	Nut	68	Washer	113	Blade
24	Lockwasher	69	Capscrew	114	Wheel
25	Washer	70	Nut	115	Brace
26	Bevel washer	71	Lockwasher	116	Brace
27	Capscrew	72	Capscrew	117	Nut
28	Bearing assembly	73	Nut	118	Lockwasher
29	Bushing	74	Lock	119	Capscrew
30	Trunion	75	Support	120	Brace
31	Shim	76	Nut	121	Nut
32	Shim	77	Lockwasher	122	Lockwasher
33	Shim	78	Capscrew	123	Capscrew
34	Shim	79	Spreader	124	Support
35	Shim	80	Nut	125	Nut
36	Shim	81	Lockwasher	126	Lockwasher
37	Nut	82	Capscrew	127	Capscrew
38	Lockwasher	83	Spreader	128	Support
39	Bevel washer	84	Nut	129	Screw
40	Capscrew	85	Lockwasher	130	Nut
41	Shim	86	Capscrew	131	Capscrew
42	Support	87	Support	132	Lockwasher
43	Nut	88	Support	133	Clamp
44	Lockwasher	89	Nut	134	Frame
45	Capscrew				

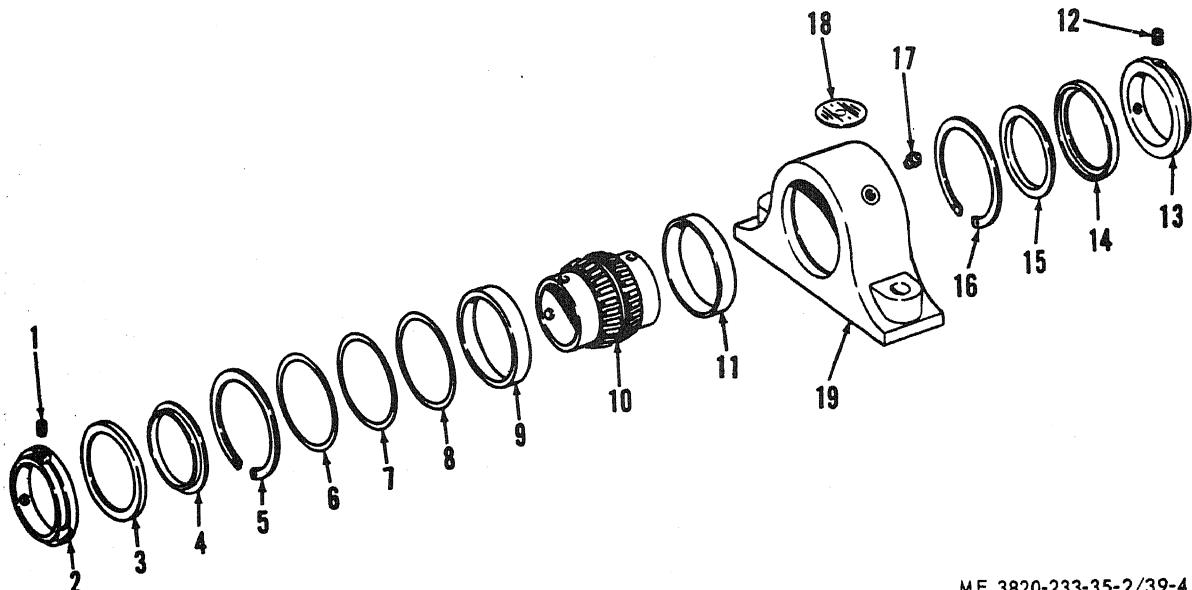
Figure 39-2—Continued



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1 Bearing 2 Fitting 3 Housing

*Figure 39-3. Sprocket idler bearing assembly,
exploded view.*



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1. Setscrew	8. Shim	15. Seal
2. Collar	9. Bearing cup	16. Snap ring
3. Seal	10. Bearing cone	17. Fitting
4. Seal	11. Bearing cup	18. Identification plate
5. Snap ring	12. Setscrew	19. Housing
6. Shim	13. Collar	
7. Shim	14. Seal	

Figure 39-4. Trunnion bearing assembly.

Section VI. VIBRATING SCREEN AND VIBRATOR UNIT

66. General

The vibrating screen receives aggregate from the overhead conveyor. It is composed of three major subassemblies: a welded steel base, full floating screen box, and a screen vibrator unit. The screen vibrator unit, from which the screen derives its motion, is driven by V-belts from the screen drive countershaft. The directional movement of the screen box is determined by the position of the two eccentric shafts of the vibrating unit, and the angular position of the screen box support springs. During each cycle of the screen action, the screen box and aggregate move forward and upward at an angle of 35°. When the extreme upward movement is reached, the screen drops away from the aggregate. Each cycle lifts the aggregate

and moves it forward toward the discharge end of the screen providing efficient screening action and separation of the aggregate according to size screen wire openings in the box. The oversized aggregate drops from the discharge end of the vibrating screen to the roll crusher for resizing.

67. Vibrating Screen

a. Removal

- (1) Remove the vibrating screen, vibrator unit, and screen hopper (para 27).
- (2) Place a suitable support under the vibrator unit (fig. 40-1) and remove capscrews and nuts (38 and 40, fig. 40-3) from bearing housings (44 and 45).

(3) Lift screen assembly from the vibrator unit.

b. *Screen Box Disassembly.* Disassemble the screen box assembly in the numerical sequence as illustrated on figure 40-2.

c. *Cleaning, Inspection, and Repair*

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect for cracks, breaks, wear, or extensive damage. Repair cracks and breaks by welding if possible. Replace defective parts as necessary.

d. *Screen Box Reassembly*

(1) Reassemble the screen box assembly in the reverse of the numerical sequence as illustrated on figure 40-2.

Important: Reassemble leaf or support springs (48, fig. 40-2) so that bands are staggered as shown on figure 40-1.

(2) Adjust the coil springs so that the compression is the same on springs opposite each other (Operator's Manual).

Note. Before tightening leaf spring capscrews shown on figure 40-1, check for equal distance between base and box on all four corners to make sure the box is square in the base.

e. *Screen Hopper Disassembly.* Refer to figure 40-4 and disassemble the screen hopper assembly.

f. *Cleaning, Inspection and Repair.*

(1) Clean the screen hopper with live steam or an approved cleaning solvent.

(2) Inspect the hopper for excessive wear or damage. Repair or replace a damaged or defective hopper.

(3) Inspect hopper liner for wear or damage. Replace worn or damaged liners as necessary.

(4) Inspect the flop gate and flop gate handle for a bent or damaged condition. Repair or replace defective parts.

g. *Screen Hopper Reassembly.* Refer to figure 40-4 and reassemble the screen hopper assembly.

h. *Installation.*

(1) Refer to figure 40-1 and install the vibrator unit to the screen box assembly. Secure bearing housings (44 and 45, fig. 40-

3) to the screen base with capscrews and nuts (38 and 40).

(2) Install the vibrating screen and screen hopper (para 27).

68. **Vibrator Unit**

Note. Whenever the cause of bearing failure is determined to be on one side of the vibrator unit only, the bearing can be removed without removing the vibrator unit from the screen box. For complete overhaul, the safest method is to remove the vibrator unit.

a. *Bearing Removal and Installation (Drive Side).*

(1) *Drive Shaft Bearing Removal.*

(a) Remove screen pulley (fig. 8).

(b) Remove rotating seal (30, fig. 40-3).

(c) Remove fixed seal (34, fig. 40-3).

(d) Attach puller ring (Special Tool 1376-036-02) to inner race of the drive shaft bearing (fig. 40-5).

(e) Attach bearing puller plate to puller ring and remove the drive shaft bearing (fig. 40-6).

Caution: Never use an acetylene torch to heat bearings for removal. Heat over 500° F will cause the housing bores to lose their concentricity and smooth surfaces.

(f) Lift the drive shaft slightly and remove the inner rotating seal (37, fig. 40-3).

(g) Inspect seals (34 and 37) and seal (49) (that is bolted to the inside of housing 45). Replace defective seals.

(h) Inspect the bearing housing bores for nicks, burrs, out-of-round, or oversize. If bearing housing is defective, it must be replaced.

(2) *Drive Shaft Bearing Installation.*

(a) Clean all parts with an approved cleaning solvent and dry thoroughly.

(b) Install inner rotating seal (37, fig. 40-3) onto shaft (50) until it seals firmly against the eccentric part of the shaft.

Note. Do not use oil or lubricant in the grooves of the seals as lubricant will prevent proper seating of the seals.

(c) Remove plug (1) and drain lubricant from gear case.

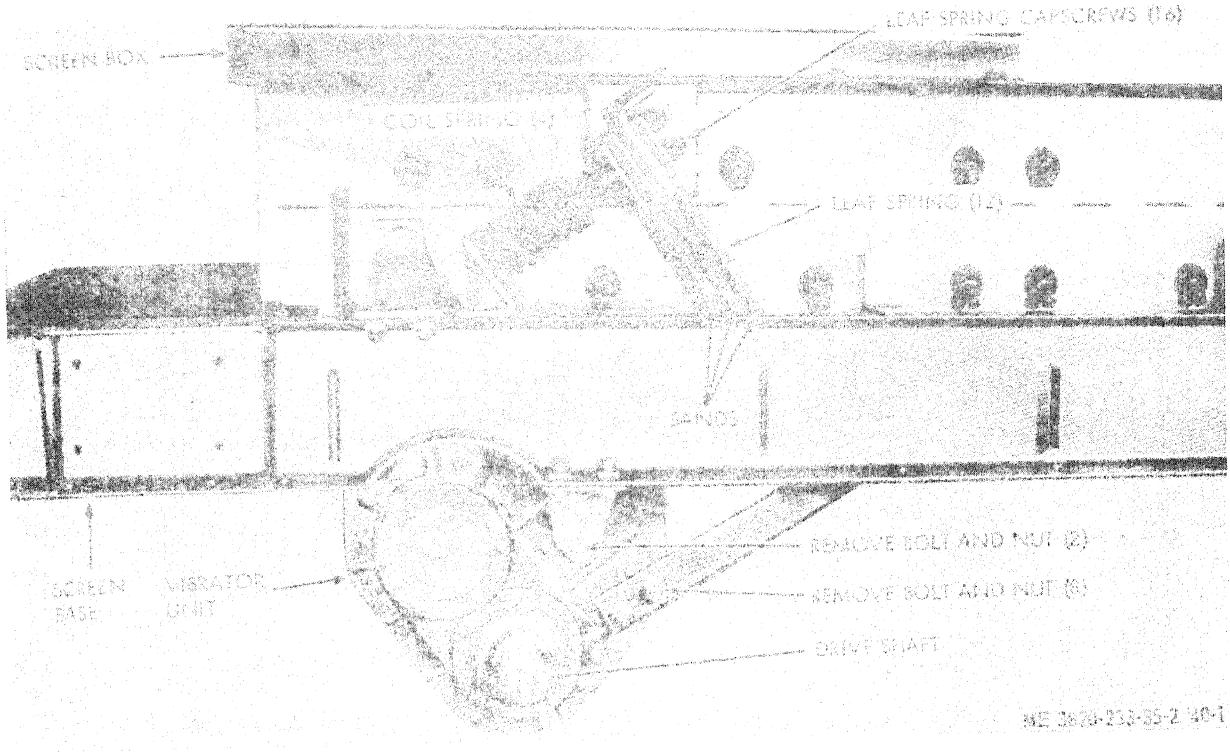


Figure 40-1. Vibrating screen assembly.

(d) Remove cover (8), gasket (9), and end plates (17).

(e) Remove both timing gears using the Special Tools shown on figure 40-7. Turn driven shaft until keyway is at bottom of shaft. Hold shaft in this position while removing gear. This will prevent the shaft from "swinging free" when gear is removed. Repeat procedure for remaining gear.

(f) Remove back plate (24, fig. 40-3) and gaskets (25).

(g) Install bearing into housing. Press bearing onto drive shaft using the Special Tools shown on figure 40-8. Be sure to assemble holding tool also illustrated on figure 40-8, to prevent shaft from moving laterally.

(h) Press bearing into the housing until the inner race of bearing seats firmly against inner rotating seals.

(i) Remove long mounting tool and holding tool. Install fixed seal (34, fig. 40-3).

(j) Install rotating seal (30).

(k) Measure for a minimum 0.010 clearance between the rotating seal (30) and the fixed seal (34).

(l) Refer to the Operator's Manual for bearing lubrication instructions.

(m) Install the screen pulley (fig. 8).

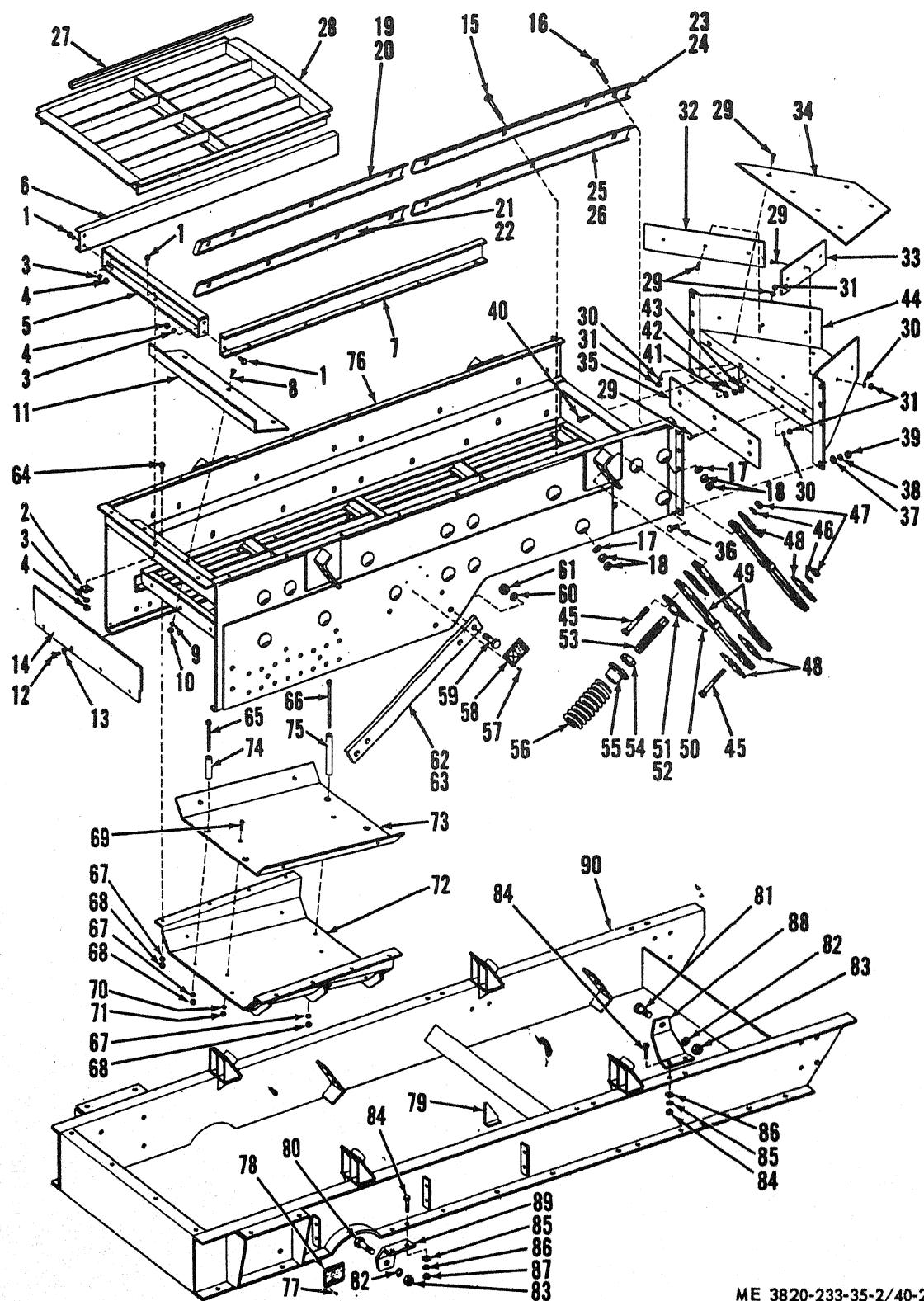
(n) Coat the bolt circles on inner side of back plate (24, fig. 40-3) with nonhardening gasket sealant. Install gaskets (25) to back plate.

(o) Apply liquid sealant to back plate mounting screw threads. Install back plate and torque mounting screws (22) to 25 lb. ft. Install locking wire (21).

(p) Install gears and align timing marks as shown on figure 40-8.

Note. Make sure timing marks are correctly aligned before installing keys in step q.

(q) Rotate the timed gears until the gear and shaft keyways are aligned. Drive keys into keyway.



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Figure 40-2. Screen box assembly, exploded view.

1	Capscrew	31	Nut	61	Nut
2	Bevel washer	32	Liner	62	Brace
3	Lockwasher	33	Liner	63	Brace
4	Nut	34	Liner	64	Capscrew
5	Dust shield	35	Liner	65	Capscrew
6	Dust shield	36	Capscrew	66	Bolt
7	Cover	37	Washer	67	Lockwasher
8	Bolt	38	Lockwasher	68	Nut
9	Lockwasher	39	Nut	69	Bolt
10	Nut	40	Capscrew	70	Lockwasher
11	Liner	41	Washer	71	Nut
12	Capscrew	42	Lockwasher	72	Pan
13	Lockwasher	43	Nut	73	Liner
14	Plate	44	Chute	74	Spacer
15	Bolt	45	Capscrew	75	Spacer
16	Bolt	46	Lockwasher	76	Box
17	Washer	47	Nut	77	Screw
18	Nut	48	Pad	78	Plate
19	Clamp (RH)	49	Leaf spring	79	Straight edge
20	Clamp (LH)	50	Cotter pin	80	Capscrew
21	Clamp (RH)	51	Seat (RH)	81	Capscrew
22	Clamp (LH)	52	Seat (LH)	82	Lockwasher
23	Clamp (RH)	53	Jack	83	Nut
24	Clamp (LH)	54	Nut	84	Capscrew
25	Clamp (RH)	55	Nut	85	Washer
26	Clamp (LH)	56	Spring	86	Lockwasher
27	Channel	57	Screw	87	Nut
28	Frame	58	Plate	88	Brace
29	Bolt	59	Capscrew	89	Brace
30	Lockwasher	60	Lockwasher	90	Base

Figure 40-2—Continued

(r) Install end plates (17, fig. 40-3), lockwashers (16), capscrews (15), and locking wire (14).

(s) Install gear case cover (9) using a new gasket (9). Tighten capscrews (5) securely. Install plug (1).

(t) Refer to the Operator's Manual for timing gear lubrication instructions.

(3) Driven Shaft Bearing Removal.

(a) Remove end cap (fig. 40-5).

(b) Remove end plate (17, fig. 40-3) from driven shaft (51).

(c) Remove the driven shaft bearing in the same manner as the drive shaft bearing. Repeat steps (d) through (h) under step a (1) above.

Note. Use shorter bolts than those shown on figure 40-6 to assemble plate to puller ring.

(4) Driven Shaft Bearing Installation.

(a) Refer to step a(2) above, and repeat instructions (a) through (l).

Note. Use the short mounting tool shown on figure 40-10 in place of the long mounting tool shown on figure 40-8 when installing the driven shaft bearing.

(b) Install end plate (17, fig. 40-3) to driven shaft (51). Install end cap (13).

(c) Refer to the Operator's Manual for bearing lubrication instructions.

(d) Refer to step a(2) above, and repeat instructions (n) through (t).

b. Bearing Removal (Gear Side).

(1) Drain lubricant from gear case.

(2) Remove cover (8, fig. 40-3), gasket (9), and end plates (17).

(3) Remove both timing gears using the Special Tools shown on figure 40-7. Turn driven shaft until keyway is at bottom of shaft. Hold shaft in this position while removing gear. This will prevent the shaft from "swinging free" when gear is removed. Repeat procedure for remaining gear.

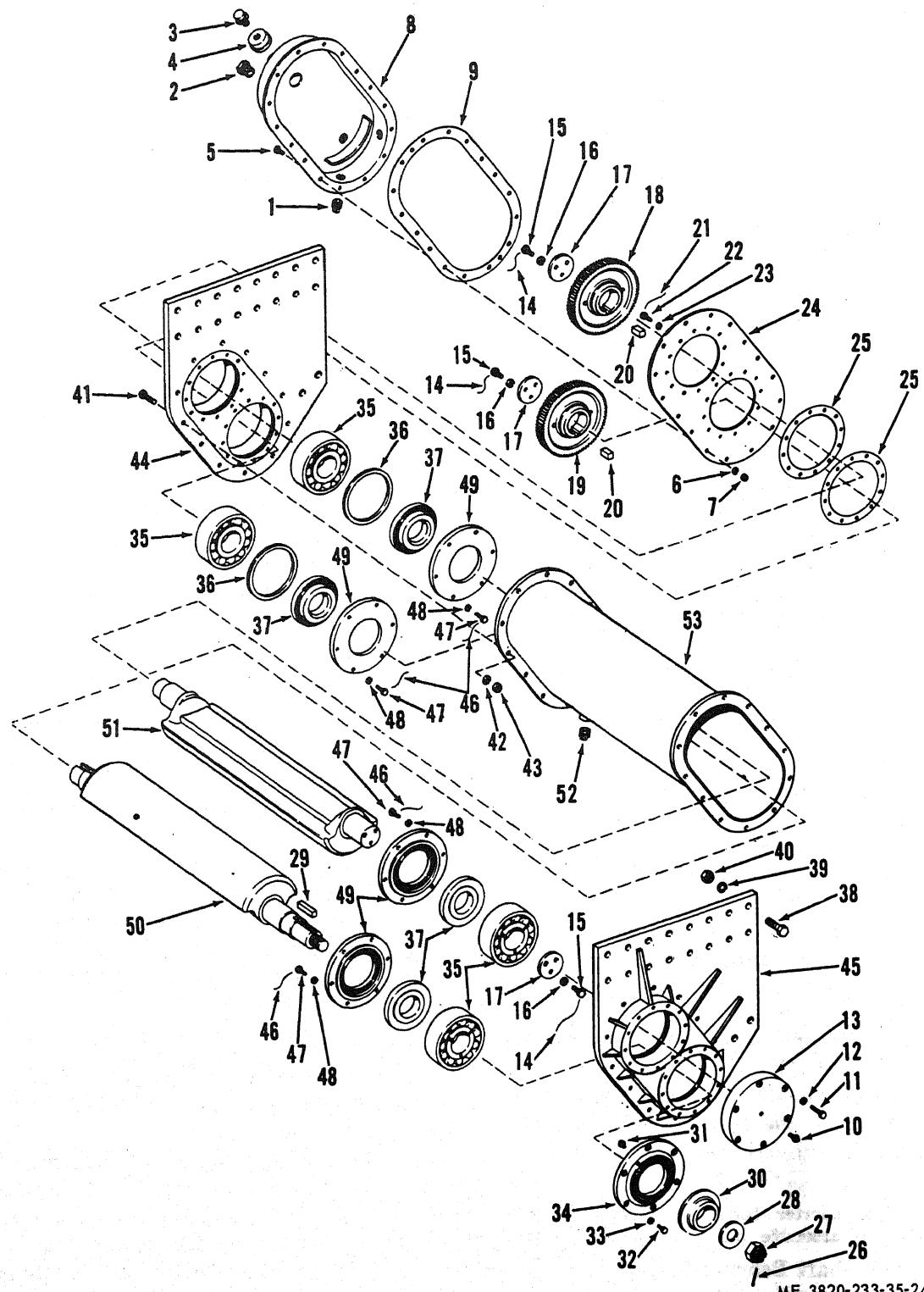


Figure 40-3. Underslung vibrator unit, exploded view.

1	Plug	19	Gear	37	Seal
2	Plug	20	Key	38	Capscrew
3	Breather	21	Lockwire	39	Lockwasher
4	Cap	22	Capscrew	40	Nut
5	Capscrew	23	Lockwasher	41	Capscrew
6	Lockwasher	24	Back plate	42	Lockwasher
7	Nut	25	Gasket	43	Nut
8	Cover	26	Cotter pin	44	Housing, Bearing
9	Gasket	27	Nut	45	Housing, Bearing
10	Fitting	28	Washer	46	Lockwire
11	Capscrew	29	Key	47	Capscrew
12	Lockwasher	30	Seal	48	Lockwasher
13	Cap	31	Fitting	49	Seal
14	Lockwire	32	Capscrew	50	Shaft
15	Capscrew	33	Lockwasher	51	Shaft
16	Lockwasher	34	Seal	52	Plug
17	End plate	35	Bearing	53	Housing, Shaft
18	Gear	36	Spacer		

Figure 40-3—Continued

(4) Remove back plate (24, fig. 40-3) and gaskets (25).

(5) Assemble puller ring (Special Tool-1376-036-02) to inner race of bearing. Remove bearing in a similar manner as shown on figure 40-6.

(6) Repeat the above procedure (5) and remove the remaining bearing.

Caution: Do not use an acetylene torch to remove the bearings. Heat over 500° F will cause the housing bores to lose their concentricity and smooth surfaces.

(7) Raise the shaft slightly, and slide inner seals (37, fig. 40-3) from shaft. Inspect seal for wear or damage and replace if necessary. Inspect seal (49) which remains attached to the inside of the bearing housing.

(8) Inspect the bearing housing bores for necks, burrs, out-of-round, or oversize. Replace a defective bearing housing.

c. Bearing Installation (Gear Side).

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Install seals (37) until they seat against eccentric part of shaft.

(3) Remove the screen pulley (fig. 8).

(4) Remove rotating seal (30, fig. 40-3), fixed seal (34).

(5) Remove end cap (8) and end plate (17).

(6) Install bearing into housing. Assemble short mounting tool (1376-036-04) and

puller plate (1376-036-01) to inner race of gear side bearing in a similar manner as illustrated on figure 40-10).

(7) Assemble the other puller plate to opposite end of shaft to hold shaft from moving laterally.

(8) Press bearing into housing until the inner race of the bearing seats firmly against bearing spacer (36, fig. 40-3).

(9) Repeat steps 6 through 8 above for installing the remaining bearing.

(10) Coat the bolt circles on inner side of back plate (24, fig. 40-3) with nonhardening gasket sealant. Install gaskets (25) to back plate.

(11) Apply liquid sealant to back plate mounting screw threads. Install back plate and torque mounting screws (22) to 25 lb ft. Install locking wire (21).

(12) Install gears and align timing marks as shown on figure 40-9.

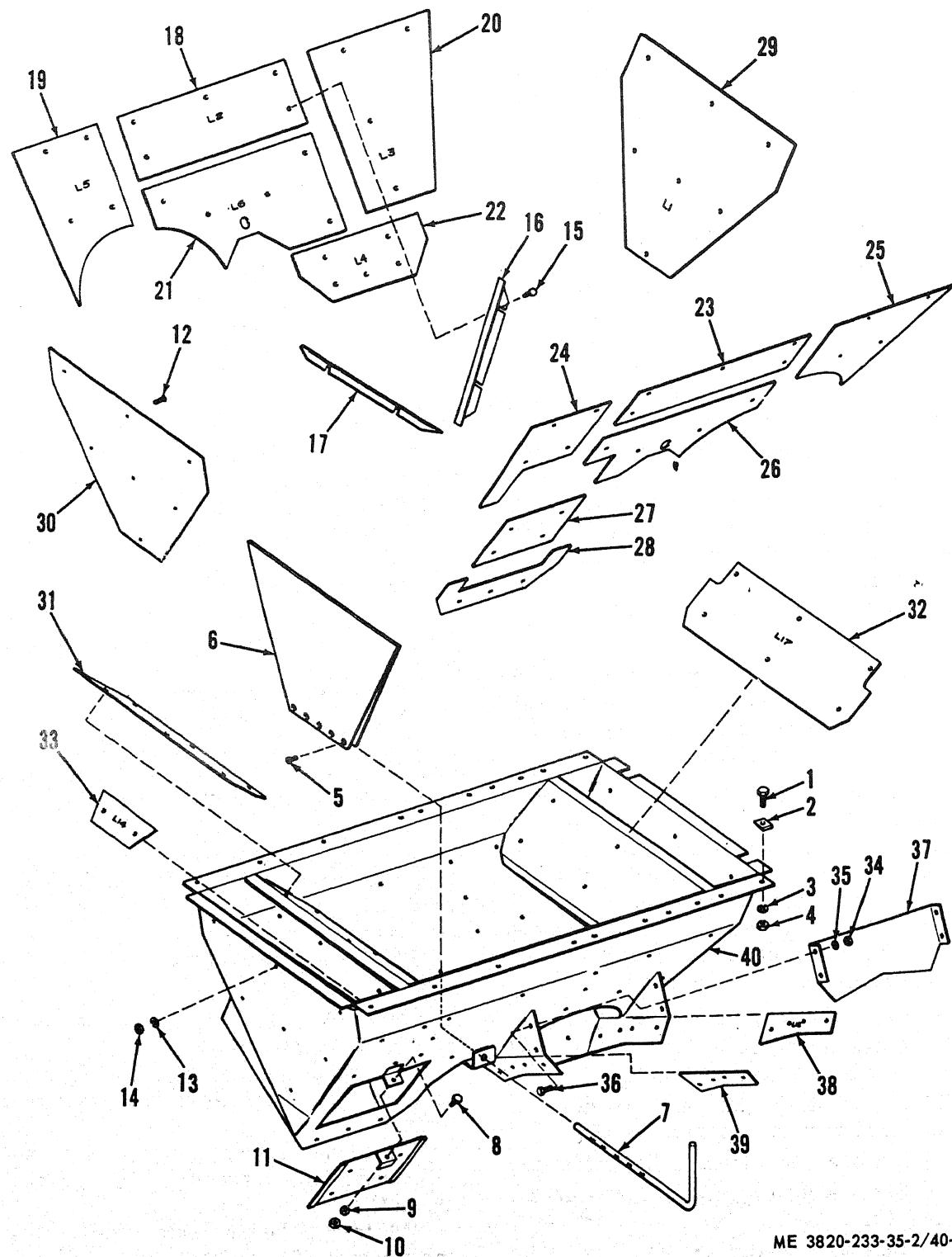
Note. Make sure timing marks are correctly aligned before installing key in step 13.

(13) Rotate the timed gears until the gear and shaft keyways are aligned. Drive keys into keyway.

(14) Install end plates (17, fig. 40-3), lockwashers (16), capscrews (15), and locking wire (14).

(15) Install the gear case cover (8) using a new gasket (9). Tighten capscrews (5) securely.

(16) Install end cap (13). Install fixed seal (34) and rotating seal (30).



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Figure 40-4. Screen hopper assembly, exploded view.

1	Capscrew	15	Capscrew	29	Hopper liner
2	Bevel washer	16	Screen stop	30	Hopper liner
3	Lockwasher	17	Screen stop	31	Partition liner
4	Nut	18	Hopper liner	32	Partition liner
5	Capscrew	19	Hopper liner	33	Gate liner
6	Gate	20	Hopper liner	34	Nut
7	Handle	21	Hopper liner	35	Washer
8	Capscrew	22	Hopper liner	36	Bolt
9	Lockwasher	23	Hopper liner	37	Liner
10	Nut	24	Hopper liner	38	Hopper liner
11	Access door	25	Hopper liner	39	Hopper liner
12	Bolt	26	Hopper liner	40	Hopper
13	Lockwasher	27	Door liner		
14	Nut	28	Hopper liner		

Figure 40-4—Continued

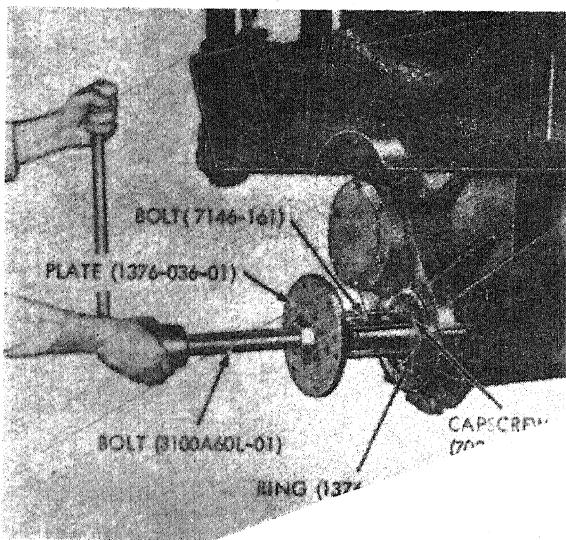
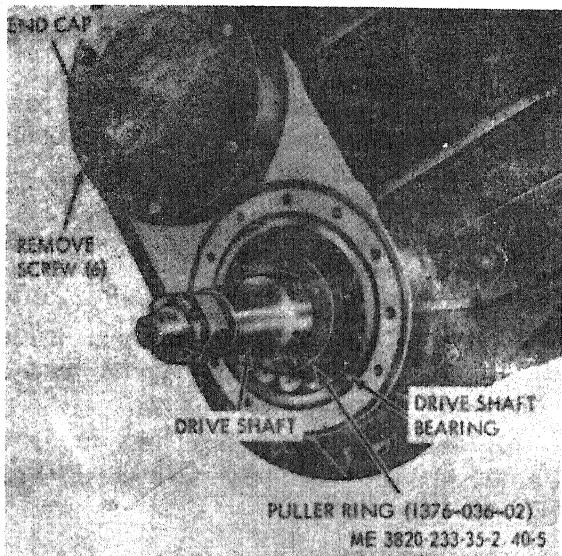


Figure 40-5. Vibrator unit.

(17) Measure for a minimum $0.06^{\prime\prime}$ clearance between the rotating fixed seal.

(18) Install screen pulley.

(19) Refer to the Operator's vibrator unit bearing and gear instructions.

d. *Vibrator Unit Removal.* Refer
e. *Vibrator Unit Disassembly.*

(1) Remove the drive shaft and shaft bearings (drive side) and inner seals in a similar manner as discussed 68a. above.

(2) Remove bearing housing and fixed seals (fig. 40-11).

- (2) Inspect the bearing housing bores for nicks, burrs, out-of-round, or oversize. Replace a defective bearing housing.
- (3) Inspect seals for wear or damage, and replace if necessary.
- (4) Inspect bearings for wear, chipping, or nicks. Replace a defective bearing.
- (5) Perform a magnetic inspection of gear and shafts. Inspect for wear, pitting, chipping, nicks, cracks, or scoring. Replace a defective gear or shaft.

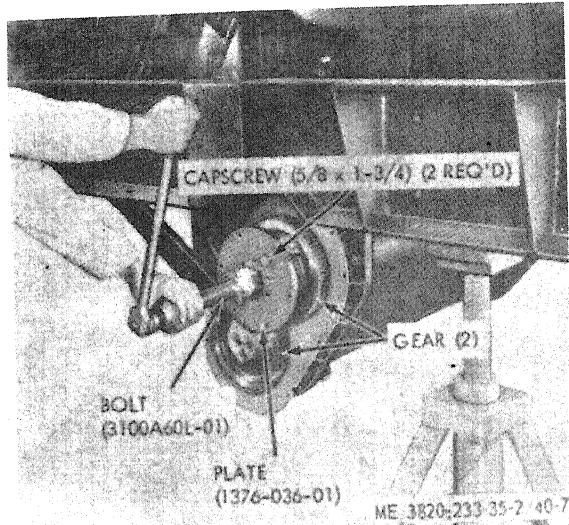


Figure 40-7. Gear removal.

Note. Gears should be replaced in matched pairs only. Single gear replacement will cause excessive backlash.

- (6) Inspect the shaft housing for excessive damage, and repair or replace as necessary.

(7) Replace all gaskets.

- (8) Inspect gear case cover breather to see that it is clean and open.

- (9) Prefit all parts before reassembly, except the bearings, and remove any imperfections that might impair proper seating of parts.

g. Vibrator Unit Reassembly.

- (1) Install and position the shafts as shown on figure 40-13).

- (2) Install inner fixed seals (fig. 40-11). Install locking wire.

- (3) Install the two bearing housings (fig. 40-11).

- (4) Push the inner rotating seals (drive side) onto both shafts until they seat firmly against the eccentric part of the shaft (fig. 40-12).

Note. Do not use oil or lubricant in the grooves of the seals as lubricant will prevent proper seating of the seals.

- (5) Install the drive shaft and driven shaft bearings (drive side) in a similar manner as discussed in step 68a. above.

- (6) Install bearing spacer into the drive shaft and driven shaft bearing housing bores, gear side (fig. 40-12).

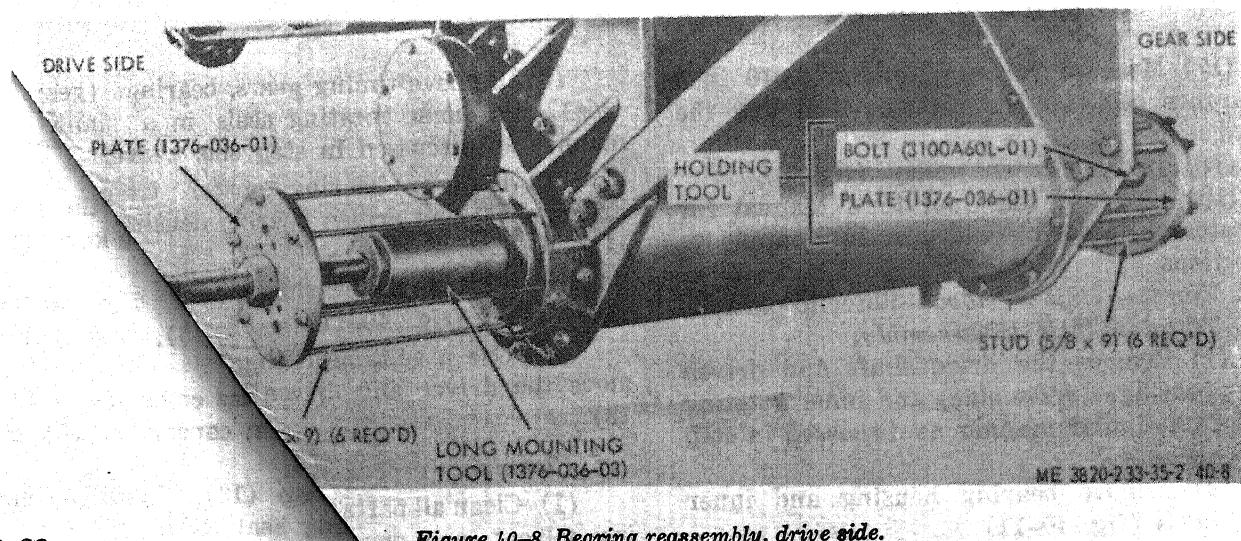


Figure 40-8. Bearing reassembly, drive side.

(7) Install the inner rotating seals (fig. 40-12). Slide seals onto shaft and into housing until they seat against the eccentric part of the shaft.

(8) Install bearings above (gear side), and timing gears in the similar manner as discussed in step 68c.

h. Vibrator Unit Installation. Refer to para 67.

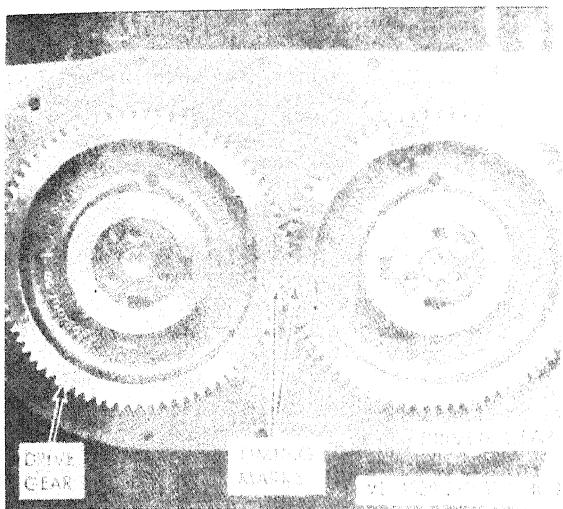


Figure 40-9. Gear installation and timing.

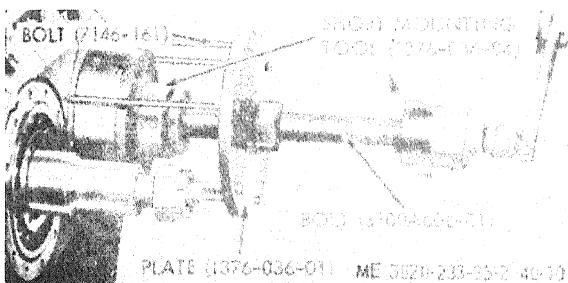


Figure 40-10. Bearing installation (short mounting tool).



Figure 40-11. Bearing housing, removal and installation.

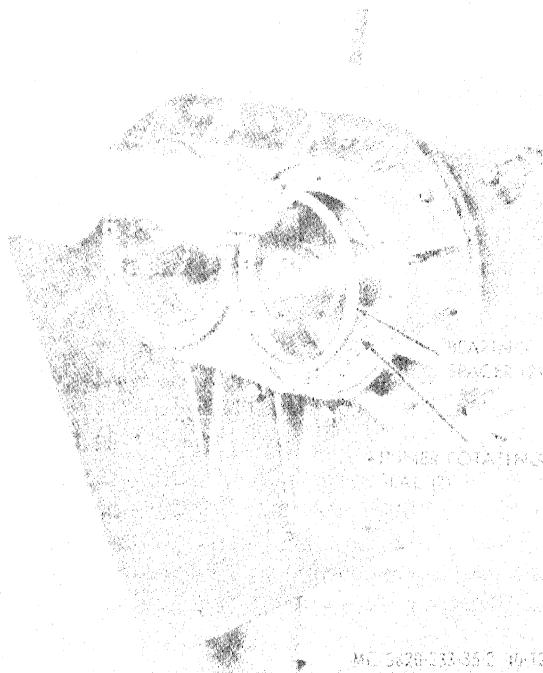


Figure 40-12. Bearing spacer and rotating seal.

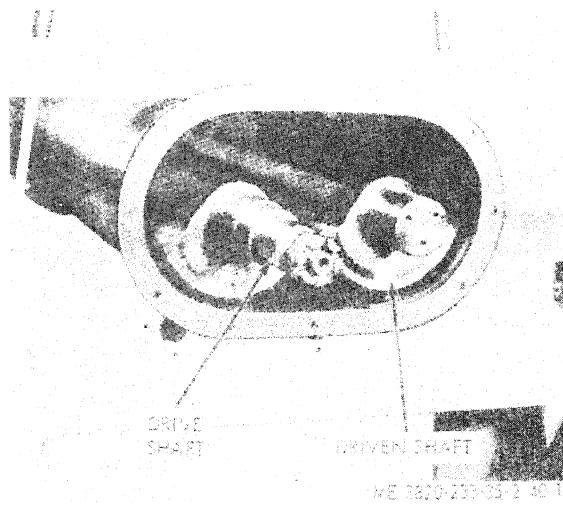


Figure 40-13. Drive shaft and driven shaft.

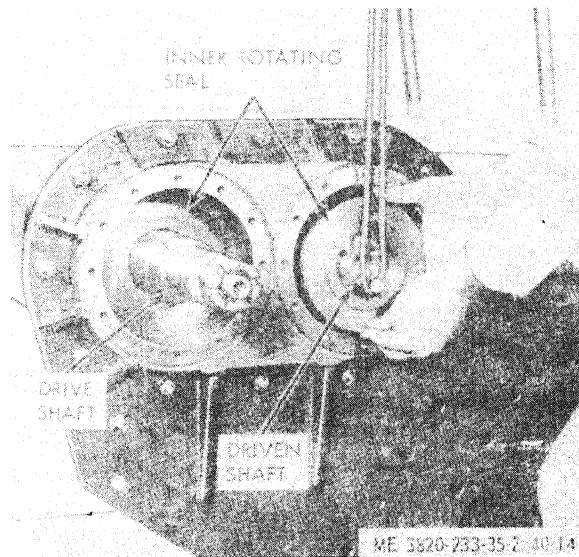


Figure 40-14. Inner rotating seal, drive end, removal and installation.

Section VII. SCREEN DRIVE COUNTERSHAFT

69. General

The screen drive countershaft drives the screen vibrating unit and is belt driven by the screen and side conveyor drive countershaft.

70. Screen Drive Countershaft

a. Removal. Remove the screen drive countershaft (Operator's Manual).

b. Disassembly. Refer to figure 41-1 and disassemble the screen drive countershaft.

c. Countershaft Bearing Disassembly. Refer to figure 41-2 and disassemble the countershaft bearing assembly.

d. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect bearings for scoring, pitting, wear or other damage. Replace a defective bearing.

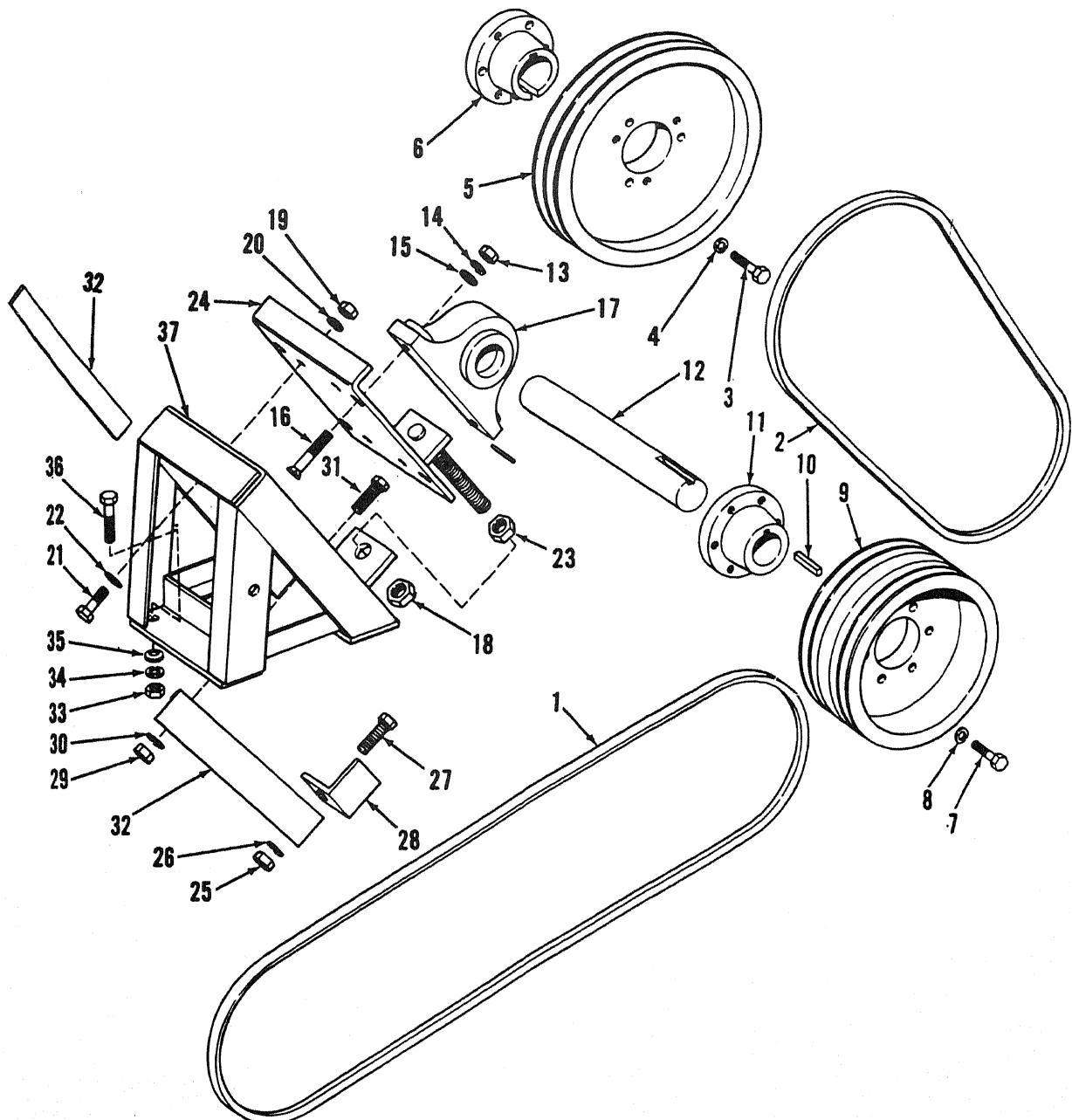
(3) Inspect countershaft for a worn or bent condition. Replace a defective countershaft.

(4) Inspect for cracks, breaks, or other damage. Repair or replace defective parts as necessary.

e. Countershaft Bearing Reassembly. Refer to figure 41-2 and reassemble the countershaft bearing assembly.

f. Reassembly. Refer to figure 41-1 and reassemble the screen drive countershaft assembly.

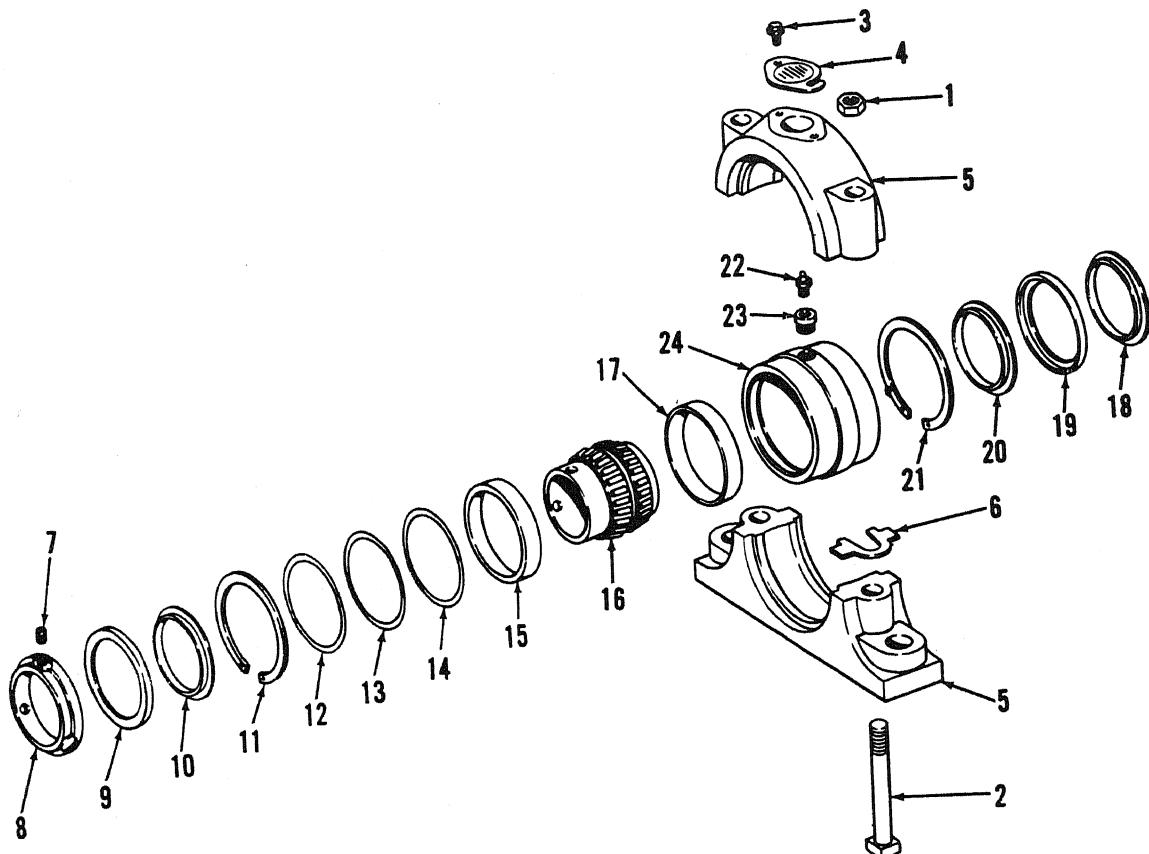
g. Installation. Install the screen drive countershaft (Operator's Manual).



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1 V-Belt	9 Sheave	17 Bearing assembly	25 Nut	33 Nut
2 V-Belt	10 Key	18 Nut	26 Lockwasher	34 Lockwasher
3 Capscrew	11 Bushing	19 Nut	27 Capscrew	35 Bevel washer
4 Lockwasher	12 Countershaft	20 Lockwasher	28 Angle clip	36 Capscrew
5 Sheave	13 Nut	21 Capscrew	29 Nut	37 Countershaft support
6 Bushing	14 Lockwasher	22 Washer	30 Lockwasher	
7 Capscrew	15 Washer	23 Nut	31 Capscrew	
8 Lockwasher	16 Capscrew	24 Bearing support	32 Brace	

Figure 41-1. Screen drive countershaft, exploded view.



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1 Nut	9 Seal	17 Bearing cup
2 Bolt	10 Seal	18 Seal
3 Screw	11 Snap ring	19 Seal
4 Nameplate	12 Shim	20 Seal
5 Housing	13 Shim	21 Snap ring
6 Shim	14 Shim	22 Fitting
7 Setscrew	15 Bearing cup	23 Stud
8 Collar	16 Bearing cone	24 Inner housing

Figure 41-2. Countershaft bearing assembly, exploded view.

Section VIII. ROLL CRUSHER

consists of four readily slide bars and movable shaft and shell assembly.

b. Material is crushed between the two roll shells, mounted on heavy shafts, which revolve toward each other and pull the rock through the opening between the shells. The stationary roll shell is mounted on a spider which is pressed and keyed on the shaft. Both ends of the shaft are mounted in roller bearing

housings, rigidly attached to the frame. The movable roll shell is mounted on a spider which is pressed and keyed on the shaft. Both ends of this shaft are mounted in roller bearing housings, which are so fitted to move under tension between the slide bars to keep the movable roll in close alignment with the fixed roll.

c. In order to transmit the power necessary for crushing and provide the required speed reduction of the roll shells, a countershaft is furnished with a pinion which drives a large gear on the shaft of the stationary roll assembly. Finger gears, located on the opposite side, synchronize the speeds of stationary and movable roll assemblies. Temporary misalignment, caused by passage of tramp iron or a surge of material, does not affect their smoothness of operation. The spur, pinion, and finger timing gears are totally enclosed in a housing.

d. The amount of opening between rolls can be increased or decreased very simply and quickly by removing or inserting shims in slots on top of the frame. A feed hopper is placed over the opening between the rolls to deliver the material to rolls.

72. Roll Crusher

a. *Removal.* Remove the roll crusher (para 26).

b. *Pinion Gear and Spur Gear Disassembly*

(1) Drain lubricant from the spur gear guard assembly (Operator's Manual).

(2) Disassemble parts 11 through 26 as illustrated on figure 42-1.

(3) Remove capscrew (27), nut (28), castle nut (29), washer (30), and key (31).

(4) Using a suitable gear puller, remove pinion gear (32).

(5) Remove bolt (33), nut (34), washer (35), castle nut (36), spindle washer (37), and key (38).

(6) Reassemble castle nut (36) on shaft, but do not tighten.

(7) Remove the spur gear using Special Tools shown on figure 42-2. When the spur gear breaks loose from the shaft attach a lifting device to the gear, and remove the castle nut and spur gear.

(8) Disassemble parts 40 through 56 (fig. 42-1).

c. *Hopper Disassembly.* Disassemble parts 57 through 101 in the numerical sequence as illustrated on figure 42-1.

d. *Tension Roll Spring and Shear Washer Disassembly.* Refer to figure 42-3 and disassemble the tension roll springs and shear washers.

Note. Spring adjusting block (224, fig. 42-1) is spot welded to the frame and countershaft housing (313), and should not be removed unless absolutely necessary.

e. *Slide Bar Disassembly*

(1) Disassemble tension roll spring and shear washer (d. above).

(2) Disassemble the slide bar and associated parts 110 through 121 in the numerical sequence as illustrated on figure 42-1.

Note. It may be desired to remove the finger gear guard and finger gears (step f) before removing the slide bars.

f. *Finger Gear Disassembly*

(1) Drain lubricant from the finger gear guard assembly (Operator's Manual).

(2) Disassemble parts 123 through 136.

(3) Remove nut (137), washer (138), bolt (139), castle nut (140), spindle washer (141), and key (142).

(4) Reassemble castle nut (140) on shaft, but do not tighten.

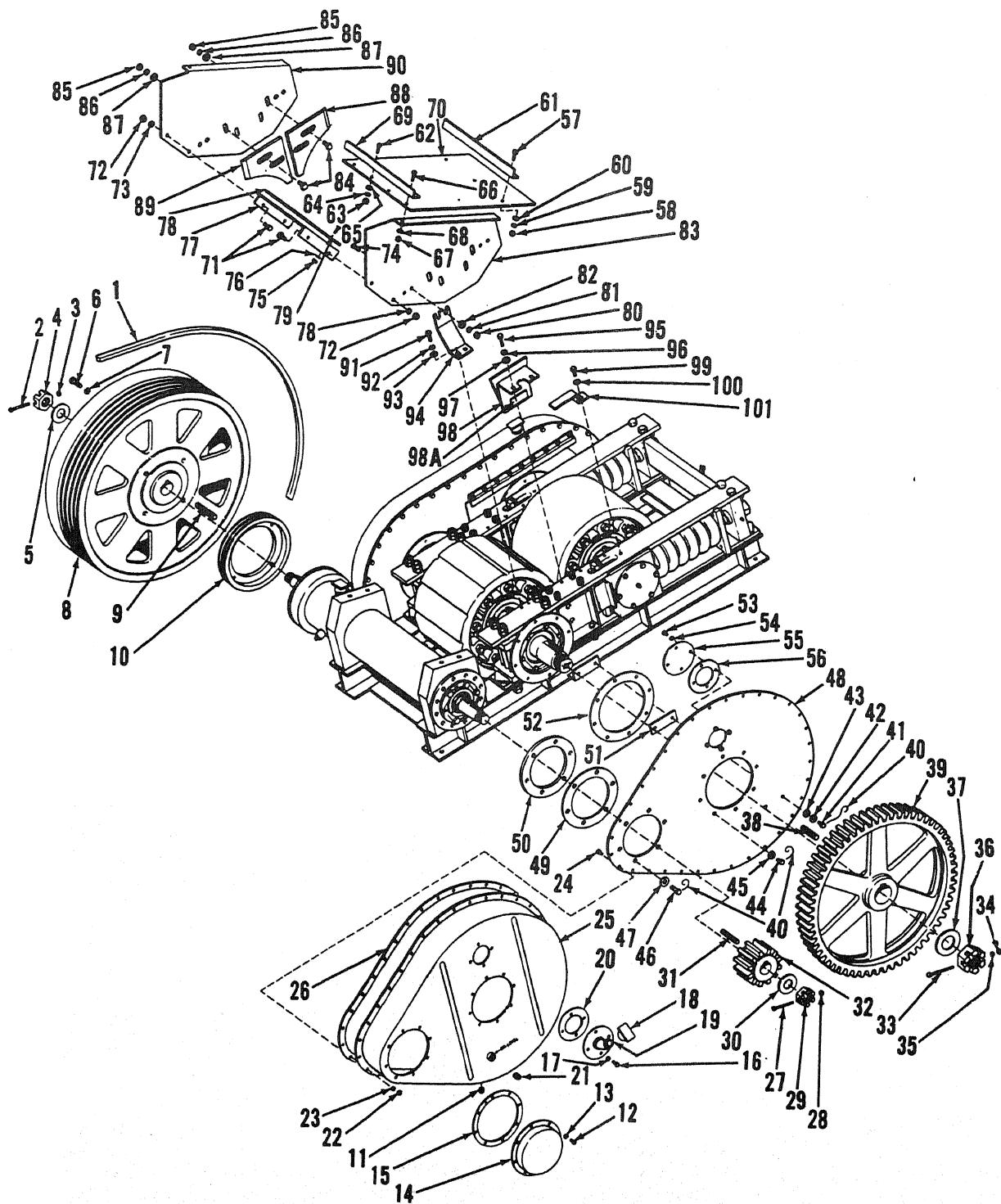
(5) Refer to figure 42-2 and remove the finger gears using Special Tools 4400A55 and 45500-752-12. When the gear breaks loose from the shaft, attach a suitable lifting device to the gear, and remove the castle nut and finger gear.

(6) Use the same procedure as discussed in steps 3 through 5 above to remove the remaining finger gear.

(7) Disassemble parts 151 through 171 in the numerical sequence as illustrated on figure 42-1.

g. *Roll Shaft Bearing Disassembly*

Note. The movable and stationary roll shaft bearing assemblies complete with roll shells are disassembled and assembled in the same manner. The movable roll shaft bearing disassembly is discussed in the following steps. The stationary bearing assembly includes parts 255 through 297 as illustrated on figure 42-1.



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Figure 42-1 (1). Roll crusher, exploded view.

1	V-Belt	35	Washer	69	Angle
2	Capscrew	36	Lock nut	70	Cover
3	Nut	37	Washer	71	Capscrew
4	Nut	38	Key	72	Nut
5	Washer	39	Spur gear	73	Lockwasher
6	Capscrew	40	Lock wire	74	Bolt
7	Lockwasher	41	Capscrew	75	Nut
8	Flywheel	42	Washer	76	Lockwasher
9	Key	43	Gasket	77	Hopper end
10	Sheave	44	Capscrew	78	Liner
11	Plug	45	Washer	79	Capscrew
12	Capscrew	46	Capscrew	80	Nut
13	Lockwasher	47	Washer	81	Lockwasher
14	End cap	48	Back plate	82	Washer
15	Gasket	49	Gasket	83	Hopper side (LH)
16	Capscrew	50	Spacer	84	Bolt
17	Lockwasher	51	Gasket	85	Nut
18	Fill cap	52	Gasket	86	Lockwasher
19	Cover	53	Capscrew	87	Washer
20	Gasket	54	Lockwasher	88	Liner
21	Plug	55	Cover	89	Liner
22	Nut	56	Gasket	90	Hopper side (RH)
23	Lockwasher	57	Capscrew	91	Capscrew
24	Capscrew	58	Nut	92	Washer
25	Housing	59	Lockwasher	93	Lockwasher
26	Gasket	60	Washer	94	Bracket
27	Bolt	61	Angle	95	Capscrew
28	Locknut	62	Capscrew	96	Lockwasher
29	Nut	63	Nut	97	Washer
30	Washer	64	Lockwasher	98	Bracket
31	Key	65	Washer	98A	Shim
32	Pinion gear	66	Capscrew	99	Capscrew
33	Bolt	67	Nut	100	Lockwasher
34	Nut	68	Lockwasher	101	Retainer

Figure 42-1 (1)—Continued.

(1) Using a suitable lifting device, remove the movable roll shaft and bearing assembly shown on figure 42-5.

(2) Refer to figure 42-1 and remove lock wire (172), capscrews (173), and bearing cap (174).

(3) Remove the oil seal (175) and shims (176, 177 and 178) from shaft and bearing block (185).

(4) Remove oiler screw (181) and capscrews (183) from inner bearing cap (191). Slide the bearing cap towards the roll shell.

(5) Using a suitable puller tool, remove bearing block (185) from bearing cones (186 and 187) and shaft (219).

(6) Remove bearing cup (179). Use a suitable puller tool (5 to 20 ton capacity) and remove bearing cones (186 and 187).

Caution: Do not heat bearings to facilitate removal. A heat 350° F or over will dam-

age the bearings. If bearings are not suitable for reuse, a saving of time can be accomplished by carefully burning them off the shaft. Caution should be taken not to burn or score the shaft during the burning operation.

(7) Remove bearing cup (188), bearing ring (189), oil seal (190), and inner bearing cap (191) from shaft.

(8) Remove the remaining bearing assembly (192 through 214) in the same manner as discussed in steps 1 through 7 above.

h. Roll Shell Disassembly.

Note. The movable and stationary roll shells are disassembled and assembled in the same manner. The roll shell being disassembled is the movable (smooth) roll shell. The roll shaft bearings previously discussed (step g) do not have to be removed to disassemble the roll shells.

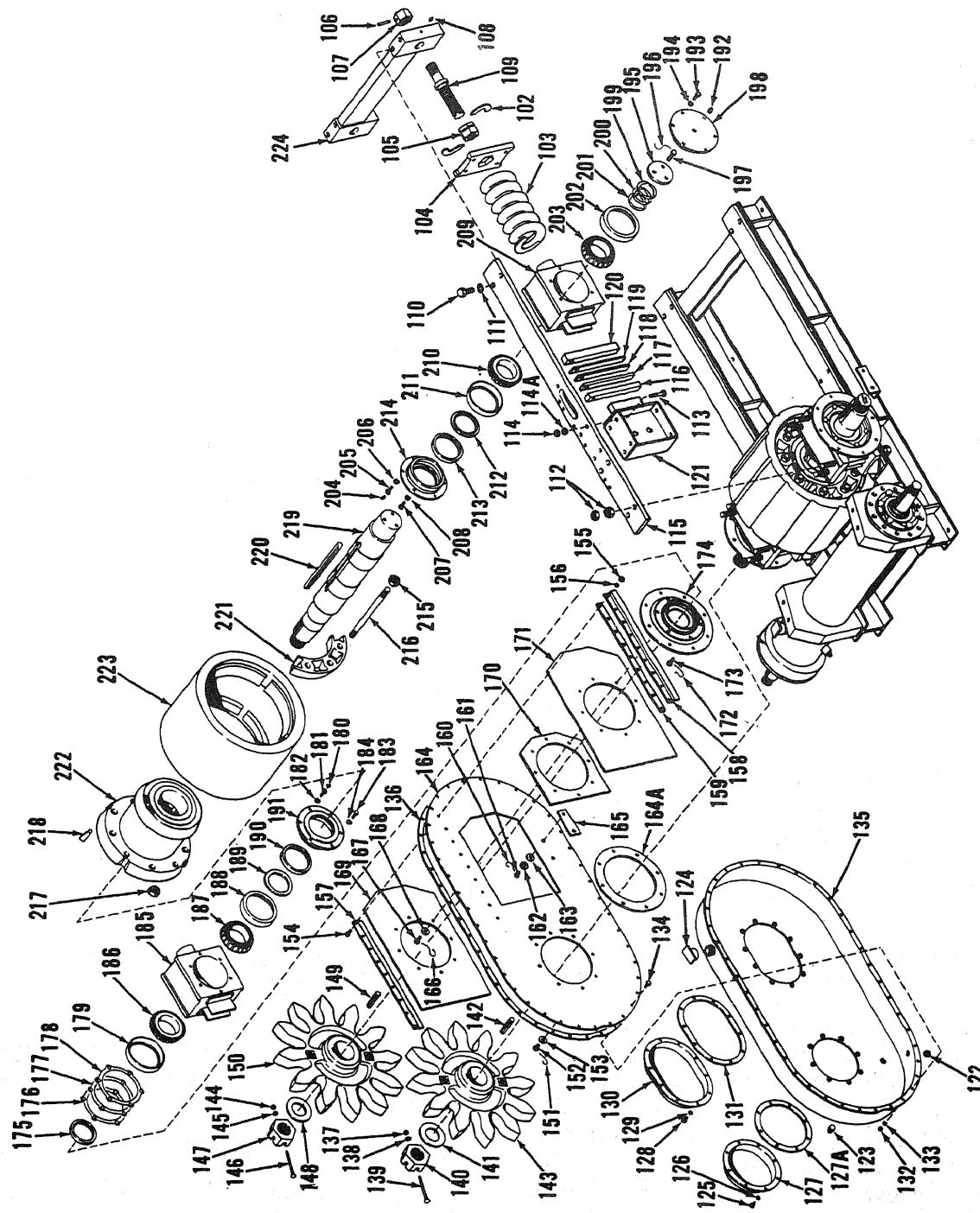
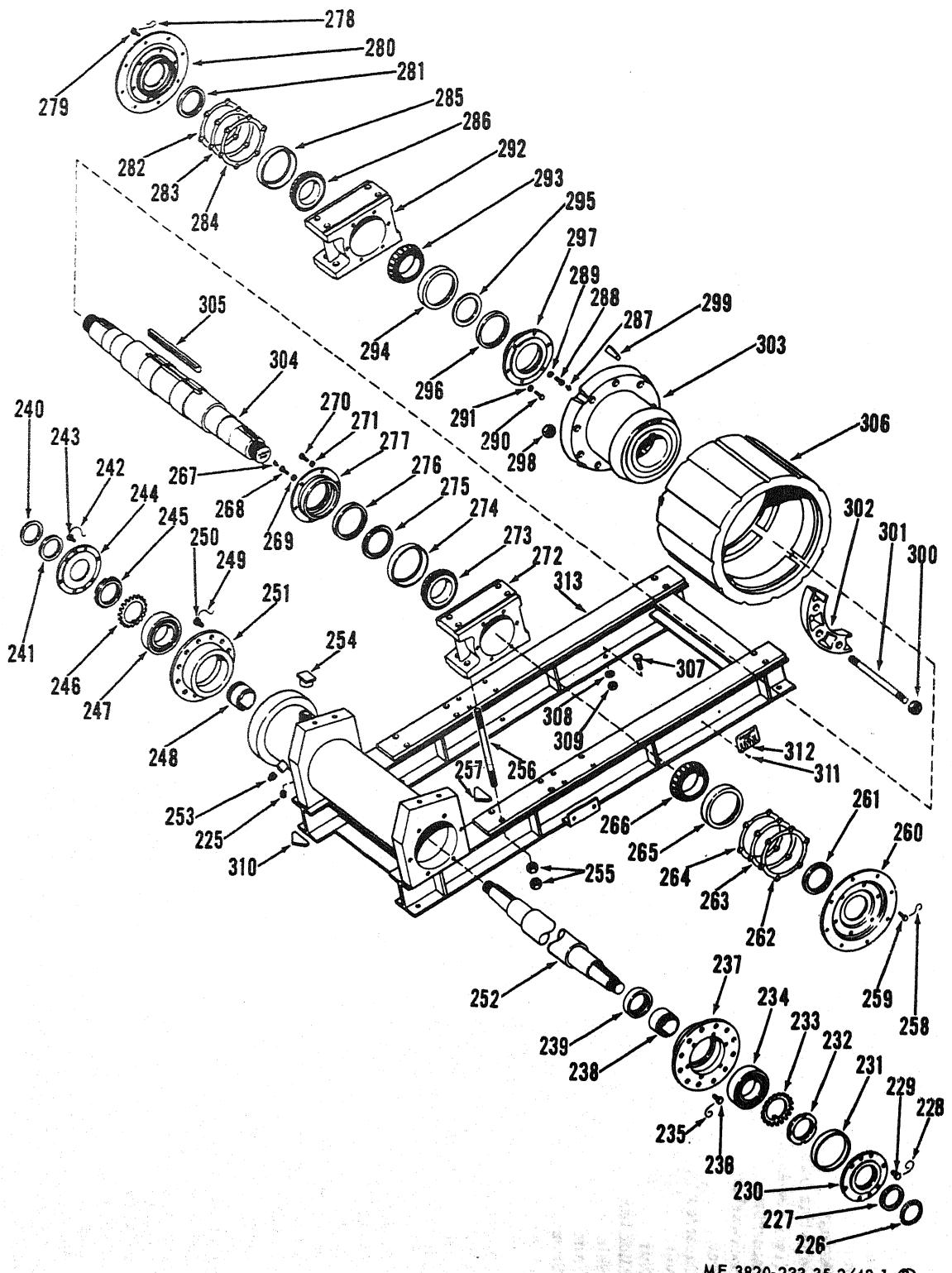


Figure 42-1 (2)—Continued.

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103	Spring	143	Finger gear
104	Shear plate	144	Locknut
105	Nut	145	Washer
106	Pin	146	Bolt
107	Nut	147	Nut
108	Fitting	148	Washer
109	Adjusting bolt	149	Key
	(Incl. 106 & 107)	150	Finger gear
110	Capscrew	151	Lock wire
111	Lockwasher	152	Capscrew
112	Nut	153	Washer
113	Capscrew	154	Capscrew
114	Nut	155	Nut
114A	Nut	156	Lockwasher
115	Slide bar	157	Guide
116	Shim	158	Guide
117	Shim	159	Gasket
118	Shim	160	Lockwire
119	Shim	161	Capscrew
120	Shim	162	Washer
121	Spacer	163	Gasket
122	Plug	164	Back plate
123	Plug	164A	Gasket
124	Fill cap	165	Gasket
125	Capscrew	166	Lockwire
126	Lockwasher	167	Capscrew
127	End cap	168	Washer
127A	Gasket	169	Shield
128	Capscrew	170	Spacer
129	Lockwasher	171	Shield
130	End cap	172	Lockwire
131	Gasket	173	Capscrew
132	Nut	174	Bearing cap
133	Lockwasher	175	Seal
134	Capscrew	176	Shim
135	Housing	177	Shim
136	Gasket	178	Shim
137	Locknut	179	Bearing cup
138	Washer	180	Fitting
139	Bolt	181	Oiler screw
140	Nut	182	Lockwasher
141	Washer	183	Capscrew
184	Lockwasher	185	Bearing block
		186	Bearing cone
		187	Bearing cone
		188	Bearing cup
		189	Bearing ring
		190	Seal
		191	Bearing cap
		192	Plug
		193	Capscrew
		194	Lockwasher
		195	Bearing cap
		196	Lock wire
		197	Capscrew
		198	End plate
		199	Shim
		200	Shim
		201	Shim
		202	Bearing cup
		203	Bearing cone
		204	Fitting
		205	Oiler screw
		206	Lockwasher
		207	Capscrew
		208	Lockwasher
		209	Bearing block
		210	Bearing cone
		211	Bearing cup
		212	Bearing ring
		213	Seal
		214	Bearing cap
		215	Nut
		216	Stud
		217	Nut
		218	Wedge
		219	Shaft
		220	Key
		221	Wedge
		222	Spider
		223	Roll shell
		224	Spring block

Figure 42-1 (2)—Continued.



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Figure 42-1 (3)—Continued

225	Plug	255	Nut	285	Bearing cup
226	Slinger	256	Stud	286	Bearing cone
227	Seal	257	Shear block	287	Fitting
228	Lock wire	258	Lock wire	288	Oiler screw
229	Capscrew	259	Capscrew	289	Lockwasher
230	Countershaft cap	260	Bearing cap	290	Capscrew
231	Spacer	261	Seal	291	Lockwasher
232	Nut	262	Shim	292	Bearing block
233	Lockwasher	263	Shim	293	Bearing cone
234	Bearing	264	Shim	294	Bearing cup
235	Lock wire	265	Roller cup	295	Bearing ring
236	Capscrew	266	Roller cone	296	Seal
237	Bearing adapter	267	Fitting	297	Bearing cap
238	Bearing sleeve	268	Oiler screw	298	Nut
239	Bearing spacer	269	Lockwasher	299	Wedge
240	Slinger	270	Capscrew	300	Nut
241	Seal	271	Lockwasher	301	Stud
242	Lock wire	272	Bearing block	302	Wedge
243	Capscrew	273	Roller cone	303	Spider
244	Countershaft cap	274	Bearing cup	304	Shaft
245	Nut	275	Bearing ring	305	Key
246	Lockwasher	276	Seal	306	Roll shell
247	Bearing	277	Bearing cap	307	Capscrew
248	Bearing sleeve	278	Lock wire	308	Lockwasher
249	Lock wire	279	Capscrew	309	Nut
250	Capscrew	280	Bearing cap	310	Shear block
251	Bearing adapter	281	Seal	311	Screw
252	Countershaft	282	Shim	312	Nameplate
253	Plug	283	Shim	313	Frame
254	Fill cap	284	Shim		

Figure 42-1 (3)—Continued



Figure 42-2. Spur gear removal.

(1) Remove the stop nuts and wedge studs which hold the segment wedges and roll shell in place on the spider (fig. 42-6).

(2) Remove the weld from anchor wedges. Remove anchor wedges from the roll shell and spider (fig. 42-6).

(3) Remove the segment wedges as shown on figure 42-7.

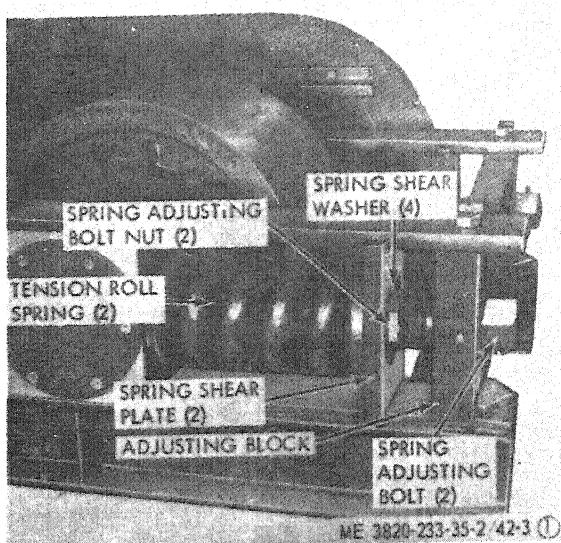
(4) Lift the roll shell from the spider and shaft (fig. 42-10).

Note. Do not remove the shaft from the spider unless the shaft or spider are extremely damaged.

(5) If a movable or stationary roll shaft must be replaced due to damaged keyways in finger and spur gears, broken shaft, or damaged bearing surface, press shaft from spider in the direction shown on figure 8. Use a press with a capacity of 125 tons.

i. Countershaft Bearing Disassembly.

(1) Drain lubricant from the countershaft housing (Operator's Manual).



STEP 1. TURN SPRING ADJUSTING BOLT CLOCKWISE UNTIL THE SPRING ADJUSTING BOLT NUT IS CLEAR OF THE SPRING SHEAR PLATE.

STEP 2. REMOVE THE SPLIT SPRING SHEAR WASHERS.

STEP 3. SLIDE SPRING SHEAR PLATE TOWARDS THE ADJUSTING BLOCK, THEN REMOVE TENSION ROLL SPRING.

Figure 42-3 (1). Tension roll spring and shear washer, disassembly and reassembly.

(2) Refer to figure 42-1 and remove slinger (226) and oil seal (227).

(3) Remove locking wire (228), cap-screws (229), countershaft cap (230) and bearing spacer (231).

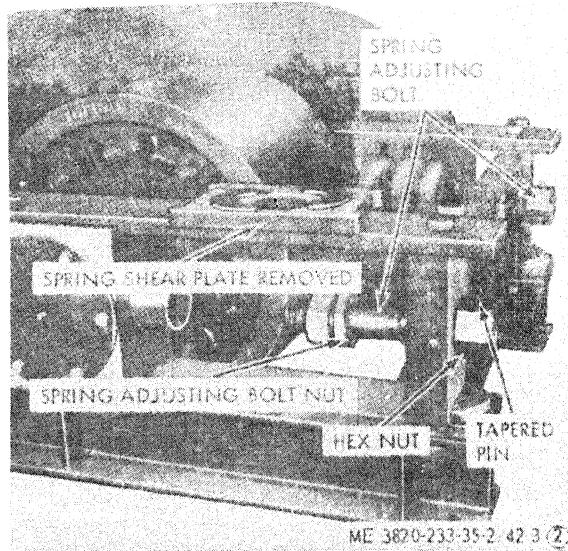
(4) Remove the bearing lock nut (232) and lockwasher (233).

(5) Position bearing lock nut (232) back onto the shaft until the face of the nut is approximately 1/8 inch away from the inner race of the bearing (234).

(6) With a bar and hammer, drive laterally on face of lock nut, rotating the point of contact, until the bearing sleeve (238) breaks loose from the bearing and sleeve.

(7) Remove the lock nut.

(8) Identify the bearing adapters (237 and 251) as to which side of the countershaft



STEP 4. SLIDE SPRING SHEAR PLATE FORWARD UNTIL IT CAN BE REMOVED FROM THE CRUSHER.

STEP 5. REMOVE THE SPRING ADJUSTING BOLT NUT.

STEP 6. REMOVE THE TAPERED PIN AND HEX NUT FROM THE SPRING ADJUSTING BOLT. REMOVE THE SPRING ADJUSTING BOLT.

Figure 42-3 (2)—Continued.

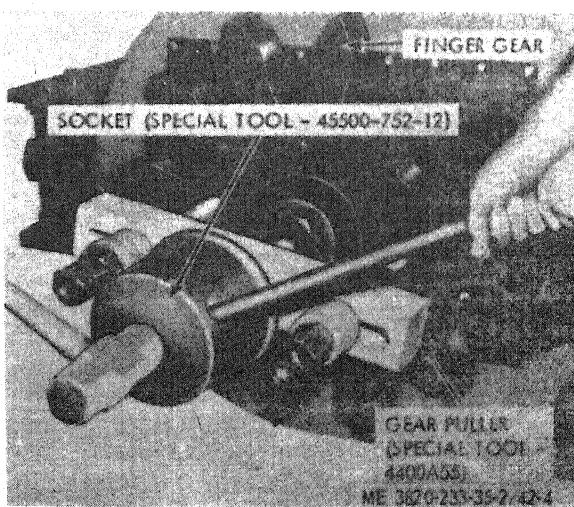


Figure 42-4. Finger gear removal.

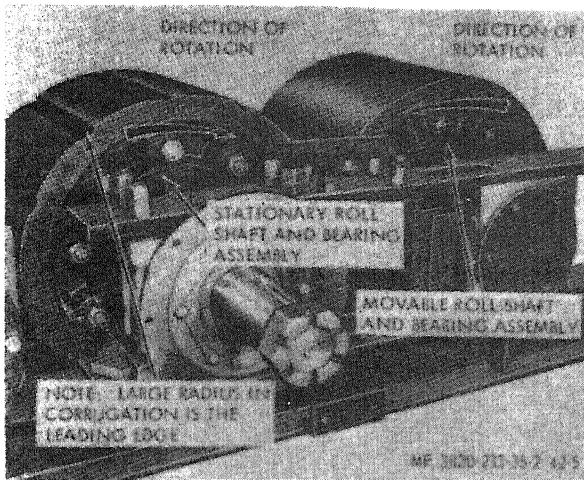


Figure 42-5. Movable and stationary roll shaft and bearing assembly, removal and installation.

housing they are located (i.e.—pinion side, flywheel side). Remove locking wire (235), cap-screws (236), and bearing adapter (237).

Note. Before removing the bearing adapters (237 and 251) note the location of the match mark on the outer surface of the bearing adapter in relation to the hole in the countershaft housing (fig. 42-9).

(9) Refer to figure 42-1 and remove slinger (240) and oil seal (241) from flywheel side of crusher.

(10) Remove locking wire (242), cap-screws (243), and countershaft cap (244).

(11) Remove the countershaft from the flywheel side of crusher.

Note. DO NOT attempt to remove the countershaft from the pinion gear side of crusher.

(12) Remove bearing sleeve (238) and bearing spacer (239) from countershaft (252).

(13) Remove lock nut (245), lockwasher (246), bearing (247), and bearing sleeve (248) from countershaft.

(14) Insert a suitable pusher tool into flywheel end of countershaft housing and drive bearing (234) from housing.

(15) Remove locking wire (249), cap-screws (250), and bearing adapter (251).

(16) Remove level plug (253) and fill plug (254) from countershaft housing.

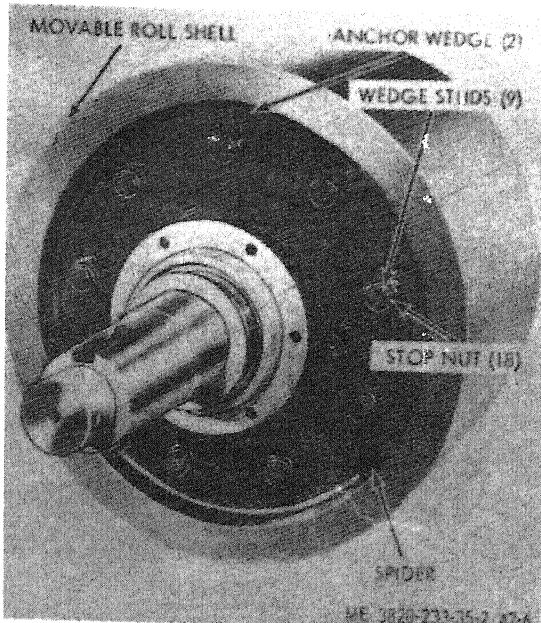


Figure 42-6. Anchor wedge, removal and installation.

j. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Perform a magnetic inspection of all gears and shafts. Inspect gear teeth for wear, pitting, chipping, nicks, cracks, or scoring. Replace defective parts.

(3) Inspect all shafts for wear or bent conditions. Replace a defective shaft. If a new shaft is to be press fit into a spider, the spider bores must be welded and rebored to ensure a proper fit.

(4) Inspect all bearings, bearing cones, and bearing cups for wear, chipping, or nicks. Replace a defective bearing.

Note. Do not replace a bearing cone or cup individually without replacing the mating cup or cone.

(5) Inspect bearing adapter bores. If the bores are 0.003 inch oversize in diameter, the bearing adapters must be replaced.

(6) Inspect housing, bearing blocks, and bearing caps to see that mating surfaces, bearing bores, etc., are free from nicks or burrs. Inspect for cracks or breaks. Repair or replace defective parts.

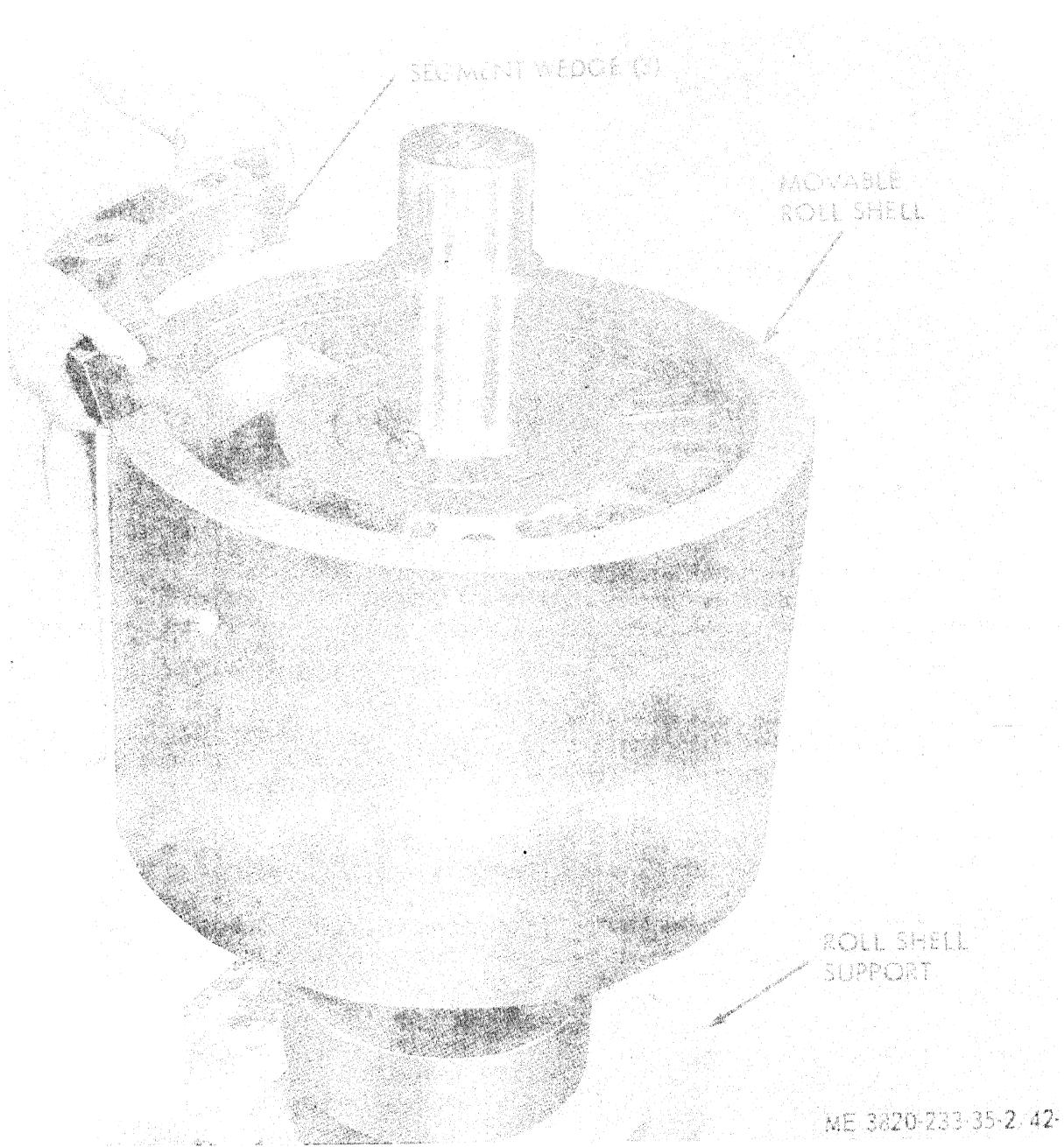


Figure 42-7. Roll shell segment wedge, removal and installation.

(7) Inspect the roll shells for wear or damage. If roll shells must be replaced, replace both shells at the same time so they will function as pairs.

(8) Replace all gaskets.

k. Roll Shell Reassembly.

Note. The movable and stationary roll shells are disassembled and assembled in the same manner. The roll shell being assembled is the movable (smooth) roll shell. Always assemble smooth shell on the movable shaft assembly. Assemble corrugated shell with corrugations rotating as shown on figure 42-5.

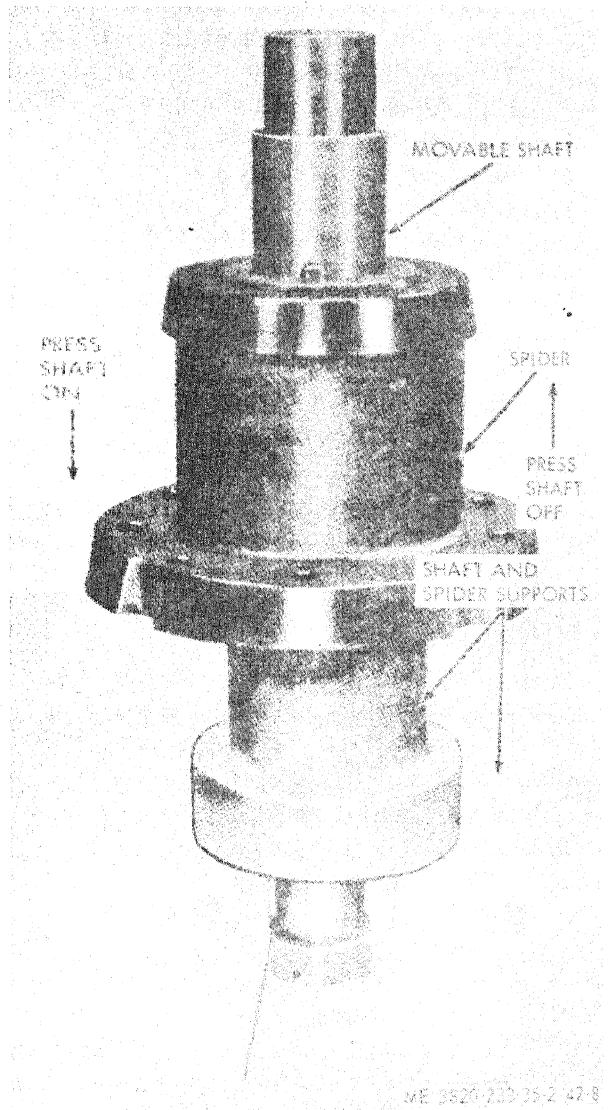


Figure 42-8. Shaft and spider assembly.

(1) If the shaft was removed from the spider, press shaft into spider in the direction shown on figure 42-8. Use a press with a capacity of 30-60 tons.

(2) Support the shaft and spider assembly on supports as shown on figure 42-8.

(3) Using the specially designed tool shown on figure 42-10, lower the roll onto the shaft and spider assembly. Be sure to align the square slots in the roll shells shown on

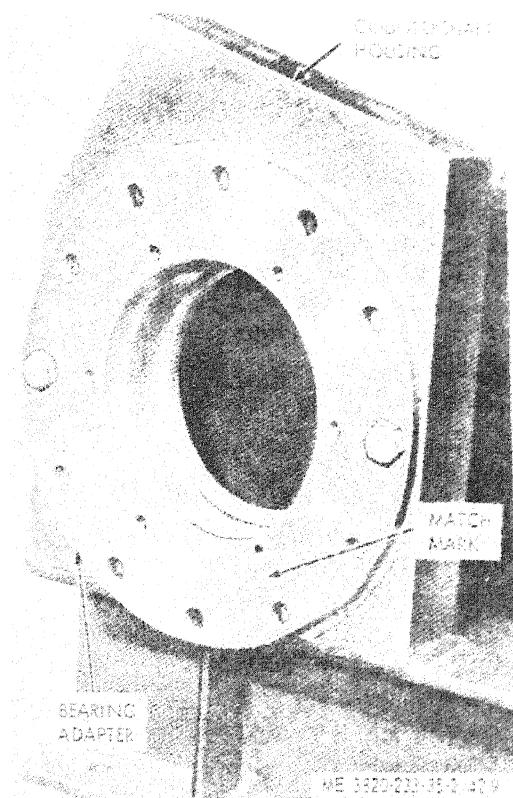


Figure 42-9. Bearing adapter-to-countershaft housing alignment.

figure 42-11, with the anchor wedge slots on the spider shown on figure 42-10.

(4) Tap the roll shell with a hammer at various points to seat it firmly on the spider.

(5) Assemble the segment wedges as shown on figure 42-7. Aline the holes in the wedges with the opposite end holes in spider.

(6) Install the wedge studs through the holes in segment wedges and spider. Install stop nuts onto the threads of the studs just far enough to hold the roll shell in position.

(7) Position the roll shell assembly as shown on figure 42-6 and tighten the stop nuts evenly. Tap the roll shell and segment wedges with a hammer to seat all parts and obtain maximum tightness.

(8) Install anchor wedges shown on figure 42-6. Weld anchor wedges to the spider.

l. Roll Shaft Bearing Reassembly. (Refer to fig. 42-1.)

Note. The movable and stationary roll shaft bearing assemblies are disassembled and assembled in the same manner. The movable roll shaft bearing reassembly is discussed in the following steps.

(1) Install oil seal (190) into bearing cap (191). Be sure knife edge of seal is turned towards the spider.

(2) Install the assembled oil seal and bearing cap onto the shaft.

(3) Install bearing ring (189) into position against the "step-up" on the shaft with the outer beveled edge toward end of shaft.

(4) Assemble bearing cup (188) into bearing block (185).

(5) Install the bearing block (185) with assembled cup (188) onto the shaft.

(6) Secure bearing cap (191) to the bearing block (185) with capscrews (183) and oiler screw (181). Push this partial assembly towards the hub of the spider.

(7) Heat bearing cones (186 and 187) for approximately 20 minutes in oil at 279°F.

(8) Install bearing cone (187) onto shaft and into bearing block with the large outside diameter towards end of shaft. Slide bearing cone firmly against bearing ring (189).

(9) Install the other bearing cone (186) onto shaft and into bearing housing with the small outside diameter towards end of shaft.

(10) Install and slide bearing cup (179) firmly against bearing cone (186).

(11) Install bearing cap (174). Install three capscrews (173) equally spaced around bearing cap. Tighten capscrews until bearing cup (179) makes a positive fit against bearing cone (186).

(12) Check the clearance between bearing block and bearing cap with a feeler gauge to determine the shim thickness required.

(13) Remove the bearing cap (174).

(14) Select a combination of shims to total the determined thickness (step 11). Add 0.005 inch to 0.007 inch additional shims (176, 177 and 178).

Note. The correct amount of shim thickness will be indicated when a slight up and down movement occurs while raising and lowering the bearing block.

(15) Assemble oil seal (175) into bearing cap (174) with the knife edge of seal towards the bearings.

(16) Assemble the bearing cap (174) and oil seal (175) assembly to bearing block (185) with capscrews (173). Install lock wire (172) through holes in heads of capscrews (173).

(17) Assemble the remaining bearing assembly (192 through 214) in the similar manner previously discussed (steps 1 through 16).

(18) The assembly of the movable and stationary roll shaft and bearing assemblies, complete with roll shells, to the crusher will be discussed in the following instructions.

m. Slide Bar Reassembly.

(1) Install new slide bars.

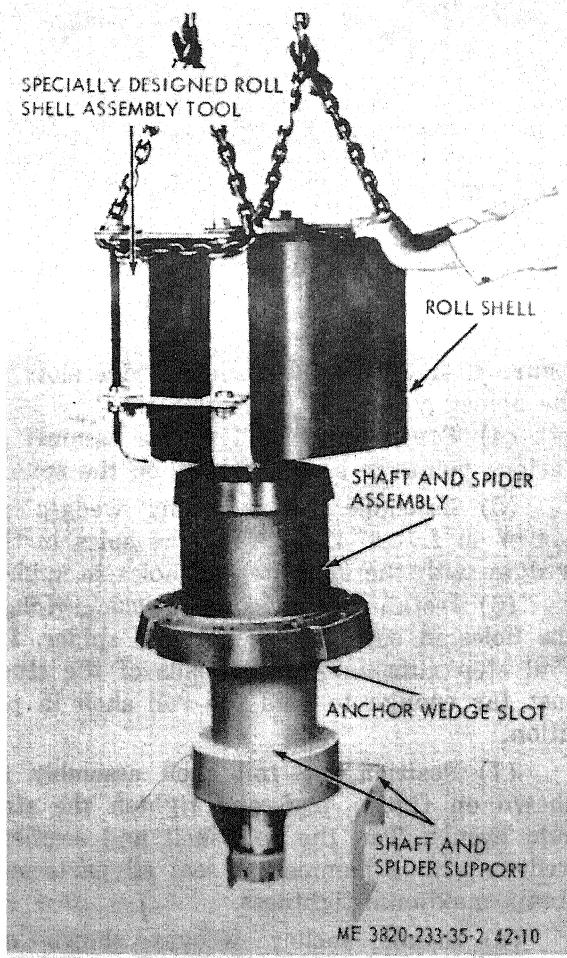


Figure 42-10. Roll shell assembly.

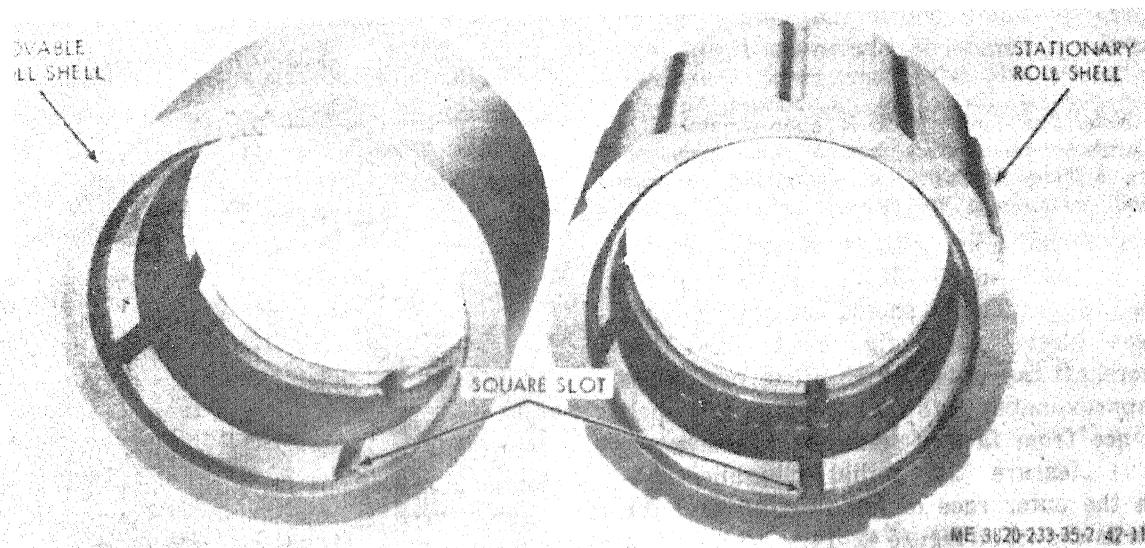


Figure 42-11. Roll shells.

(2) Install the stationary roll shaft and bearing assembly to the crusher in the position shown on figure 42-5.

(3) Align the stationary roll shaft and bearing assembly to the crusher frame by installing studs (256) and nuts (255) (fig. 42-1).

(4) Assemble the bearing block spacers (121) next to the stationary bearing blocks (272 and 292).

(5) Install the movable roll shaft and bearing assembly to the crusher in the position shown on figure 42-5.

(6) Assemble parts 110 through 120 as illustrated on figure 42-1.

n. Tension Roll Spring and Shear Washer Reassembly.

(1) Reverse the disassembly procedure discussed on figure 42-3. Do not tighten the spring adjusting bolt.

(2) Adjust the roll crusher discharge opening. The crusher discharge opening is the distance between the two roll shell faces. Add or remove shims (116 through 120, fig. 42-1) as required to close crusher opening 1/8 to 1/4 inch less than the finished product size required.

(3) Turn spring adjusting bolt shown on figure 42-3, counterclockwise until a gap of

approximately 1/2 inch exists between the tension spring coils.

Note. Compress tension roll springs evenly until an approximately 1/2 inch gap is obtained between coils.

o. Countershaft Bearing Reassembly.

(1) Assemble bearing adapters (237 and 251, fig. 42-1) to the countershaft housing. Align the match marks on the adapters with those on the countershaft housing made during disassembly (fig. 42-9).

(2) Secure the bearing adapters to the countershaft housing with capscrews (237 and 250, fig. 42-1).

(3) Install countershaft (252) into housing. Install bearing spacer (239), bearing sleeve (238), bearing (234), lockwasher (233), and lock nut (232) on the countershaft. Do not tighten lock nut (232).

(4) Center the flywheel end of shaft in bearing adapter using a clean block of wood or facsimile.

(5) Drive bearing (234) into housing until outer race of bearing shoulders against locating "stop" in bore of housing.

(6) Install bearing and sleeve assembly (245, 246, 147 and 248) onto flywheel end of countershaft. Do not tighten lock nut (245) at this time.

(7) Center countershaft in housing. Temporarily install pinion and spur gears on shafts for alinement as shown on figure 42-12.

Note. The pinion gear is approximately 1/4 inch larger across the face than the spur gear, permitting a little flexibility of countershaft location and still maintaining 100 percent gear contact.

(8) Tighten lock nut (245) with wrench (Special Tool—45500-752-04) as shown on figure 42-13. There should be no contact between sleeve (248, fig. 42-1) and the countershaft cap (244) which pilots into housing approximately 1/8 inch. Allow 1/4 inch clearance from face of housing to sleeve.

(9) Measure the radial clearance between the outer race of the bearing and the rollers as shown on figure 42-14.

Note. If the minimum 0.008 inch clearance cannot be obtained tighten lock until no further takeup is noted. Over tightening of the lock nut will stretch the nut or sleeve threads. The bearing assembly must be tight to keep sleeve from rotating on the countershaft. The clearances indicated on figure 42-14 are based on one-half of the unmounted bearing clearance.

(10) After the lock nut has been properly tightened, turn the lock nut until one of the prongs on lockwasher (246) lines up with a slot on the lock nut. Bend prong in slot with drift pin or punch.

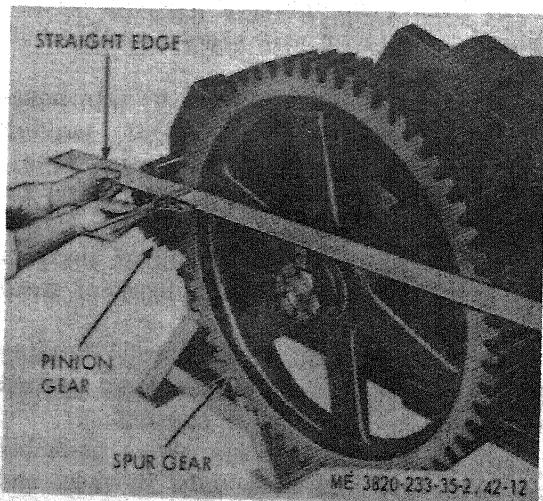


Figure 42-12. Spur and pinion gear alinement.

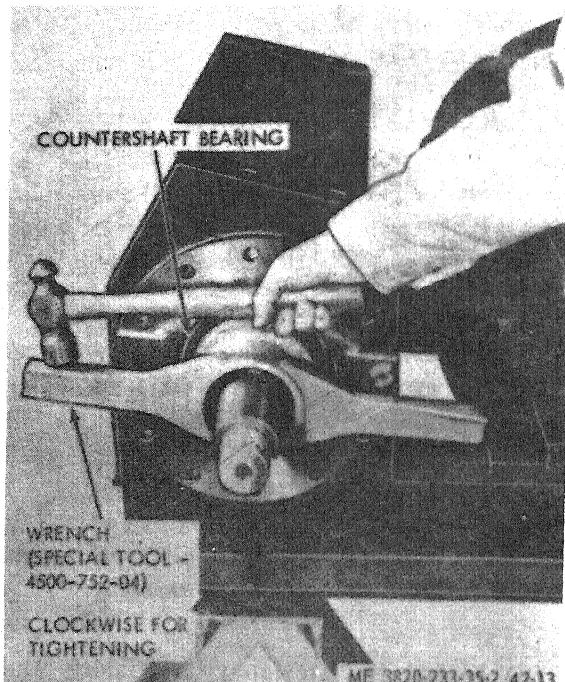


Figure 42-13. Loosening countershaft bearing.

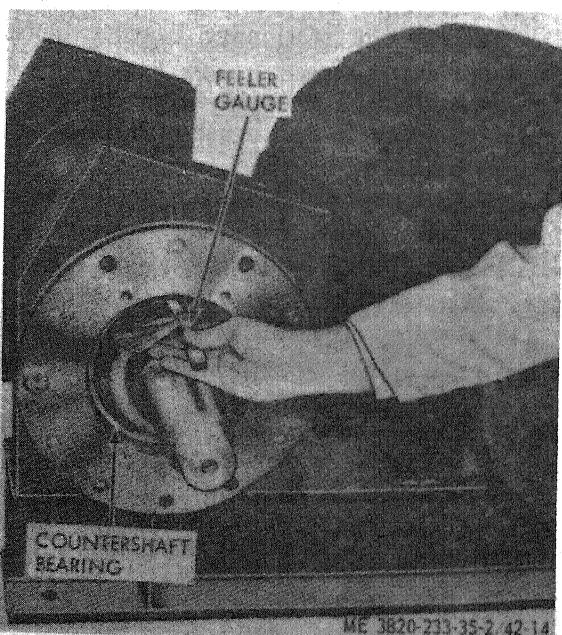


Figure 42-14. Measuring bearing clearance.

(11) Remove the spur gear and pinion from gear or fixed side of countershaft.

(12) Tighten bearing assembly (232, 233, 234 and 238) on fixed side of countershaft in the same manner as discussed in steps 8 through 10 above.

(13) Install bearing spacer (231) until it shoulders against the outer race of bearing (234).

(14) Install grease seals (227 and 241) into countershaft caps (230 and 244) with the knife edge of seal positioned towards the back side of countershaft cap.

(15) Install countershaft caps with grease seals to the bearing adapters.

Note. Exercise care installing countershaft caps with grease seals over end of countershaft.

(16) Insert lock wire (228 and 242) through heads of countershaft cap mounting capscrews (229 and 243).

(17) Grease inner surface of rubber slingers (226 and 240) and slide onto countershaft to within 1/32 inch of grease seals (227 and 241). Slinger and seal SHOULD NOT touch as one is stationary and the other rotates with the countershaft.

(18) Measure clearance between spur and pinion gear.

(a) Temporarily install the spur and pinion gears as shown on figure 42-12.

(b) Rotate the gears to a point where they have reached maximum contact with one another.

(c) Mark the point of maximum contact. The proper clearance between the spur gear and the pinion gear is determined at the bottom of teeth on spur gear and the mating pinion gear tooth crown.

(d) Slide feeler gauge between the bottom teeth of spur gear and top of teeth of pinion gear on both the inner and outer side of gears as shown on figure 42-15.

(e) The proper clearance is 0.090 ± 0.005 inch. The correct backlash is 0.016 to 0.024 inch. If the clearance measurement taken is not within the limits specified, it will be necessary to adjust the bearing adapters.

(19) Bearing Adapter Adjustment. (fig. 42-16).

Note. At "O" stamping on the bearing adapter and countershaft housing it is possible to increase or decrease four different positions from this point to change the distance between "X" (spur and pinion gear). The first hole on either side of position "O" on bearing adapter will increase or decrease the distance between spur and pinion gear from 0.0077 to 0.0115 inch, depending on size of crusher. The second hole from position "O" will increase or decrease the distance between spur and pinion gear from 0.014 to 0.021 inch depending on crusher size. The third and fourth position from "O" will further increase or decrease distance to obtain desired gear clearances.

Note. The "O" stamping described in the preceding paragraph is merely a marking to locate the central position of adapter to countershaft housing. The other match mark which is a chiseled "X" is the original setting by the factory to obtain the correct clearance.

(a) Remove the capscrews which secure the bearing adapters to the countershaft housing.

(b) Turn the bearing adapters until desired clearance (step 18e) is obtained between the gears.

Note. If the clearance and backlash measurements cannot be held due to worn gears, set the clearance dimension correctly and let the backlash be the incorrect value.

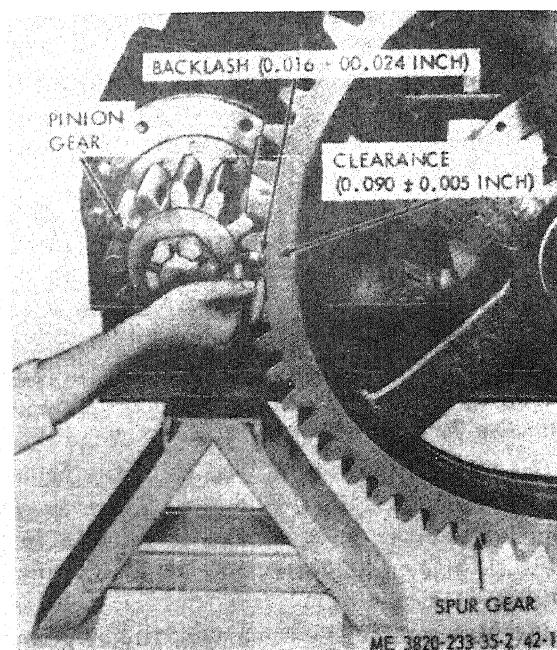
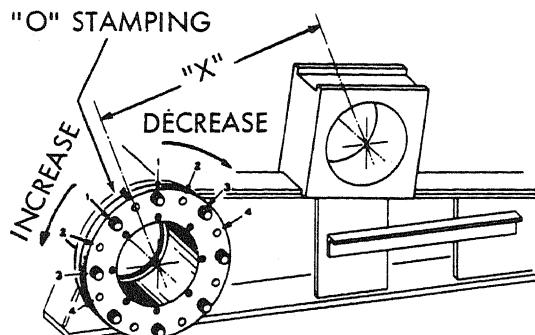


Figure 42-15. Measuring gear clearance and backlash.



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Figure 42-16. Adapter adjustment.

(c) Reassemble and tighten capscrews (236 and 250) to bearing adapters (237 and 251). Secure capscrews (250) and lock wire (249). Do not install lock wire (235) until pinion gear and spur gear are permanently installed (Pinion Gear and Spur Gear Reassembly).

(20) Remove the pinion gear and spur gear.
p. Finger Gear Reassembly

(1) Reassemble parts 151 through 171 in the reverse of the numerical sequence as illustrated on figure 42-1.

(2) Using a suitable lifting device, install finger gear (143) to shaft.

(3) Line up the keyway, and drive key (142) into place.

(4) Install washer (141) and castle nut (140).

(5) Tighten castle nut (140) using the same socket wrench (Special Tool-45500-752-12) that was used and shown on figure 42-4 for finger gear removal. Drive laterally on socket wrench while tightening nut.

Note. When tightening nut on shaft, laterally brace the opposite end of shaft to prevent brinelling the roller bearings.

(6) Refer to figure 42-1 as installing bolt (139), washer (138), and nut (137) in end of shaft. Never back up nut to align hole in shaft with hole in castle nut; always turn nut to the next opening.

(7) Reassemble the remaining finger gear in the same manner as discussed in steps 2 through 6 above.

(8) Reassemble the outer gear case housing and associated parts (123 through 136) of finger gear guard assembly as illustrated on figures 42-1.

q. *Hopper Reassembly.* Reassemble the hopper assembly (57 through 101) in the reverse of the numerical as illustrated on figure 42-1.

r. *Pinion Gear and Spur Gear Reassembly.*

(1) Remove capscrews (236) from bearing adapter (237).

(2) Reassemble parts 40 through 56 as illustrated on figure 42-1.

(3) Install capscrews (236) and lock wire (235).

(4) Using a suitable lifting device, install spur gear (39) to shaft.

(5) Line up keyways and drive key (38) in place.

(6) Install washer (37) and castle nut (36).

(7) Tighten castle nut with socket wrench (special Tool-45500-752-12) used and shown on figure 42-2 for spur gear removal. Drive laterally on wrench while tightening nut.

Note. When tightening castle nut on shaft, brace the opposite end of shaft to prevent brinelling the roller bearings.

(8) Align hole in castle nut with hole in shaft, and install bolt (33), washer (35), and nut (34). When aligning hole in castle nut with hole in shaft, never back-up the nut, always turn nut clockwise to the next opening.

(9) Install pinion gear (32) on countershaft. Line up the keyways and drive the keys (31) in place.

(10) Install washer (30) and castle nut (29).

(11) Tighten castle nut as shown on figure 42-17, driving laterally on wrench while tightening.

Note. Brace opposite end of countershaft to prevent brinelling the roller bearings.

(12) Align holes in castle nut (29) with holes in countershaft. Always turn castle nut clockwise, never counterclockwise, to align holes. Install bolt (27) and nut (28) (fig. 42-1).

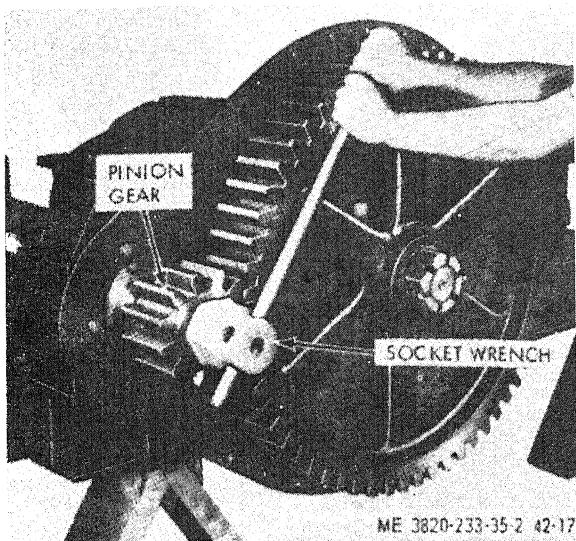


Figure 42-17. Tightening pinion on countershaft.

Section IX. UNDERCRUSHER CONVEYOR

73. General

The undercrusher conveyor is located below the roll crusher. The undercrusher conveyor receives the reduced aggregate from the roll crusher and delivers it to the elevating wheel, which carries the material to the overhead conveyor.

74. Undercrusher Conveyor

a. Removal and Disassembly

(1) Remove the conveyor belt (Operator's Manual).

(2) Remove and disassemble the undercrusher conveyor in the numerical sequence as illustrated on figure 43-1.

b. Head and Tail Pulley Bearing Disassembly. Refer to figure 43-2 and disassemble the pulley bearing assembly.

c. Trough Roll Disassembly. Refer to para 56c.

d. Cleaning, Inspection, and Repair

(1) Clean all parts in an approved cleaning solvent and dry thoroughly.

(2) Inspect pulleys for dents, cracks, and other damage. Replace a damaged pulley.

(13) Reassemble parts 11 through 26 as illustrated on figure 42-1. See figure 42-18 for installed spur gear guard assembly.

s. Installation.

(1) Fill the finger gear guard assembly, spur gear guard assembly, and countershaft housing with lubricant (Operator's Manual).

(2) Install the roll crusher (para 26).

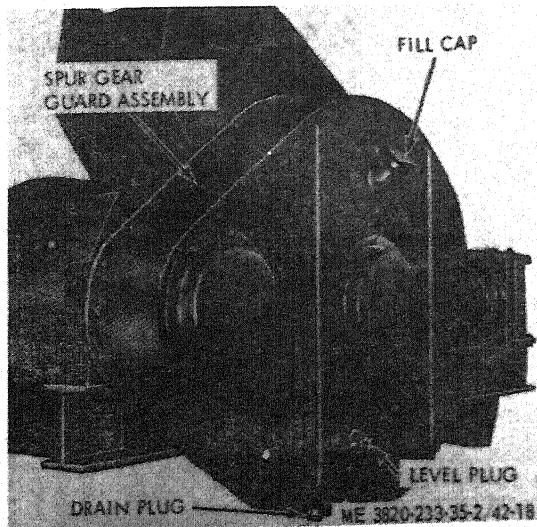
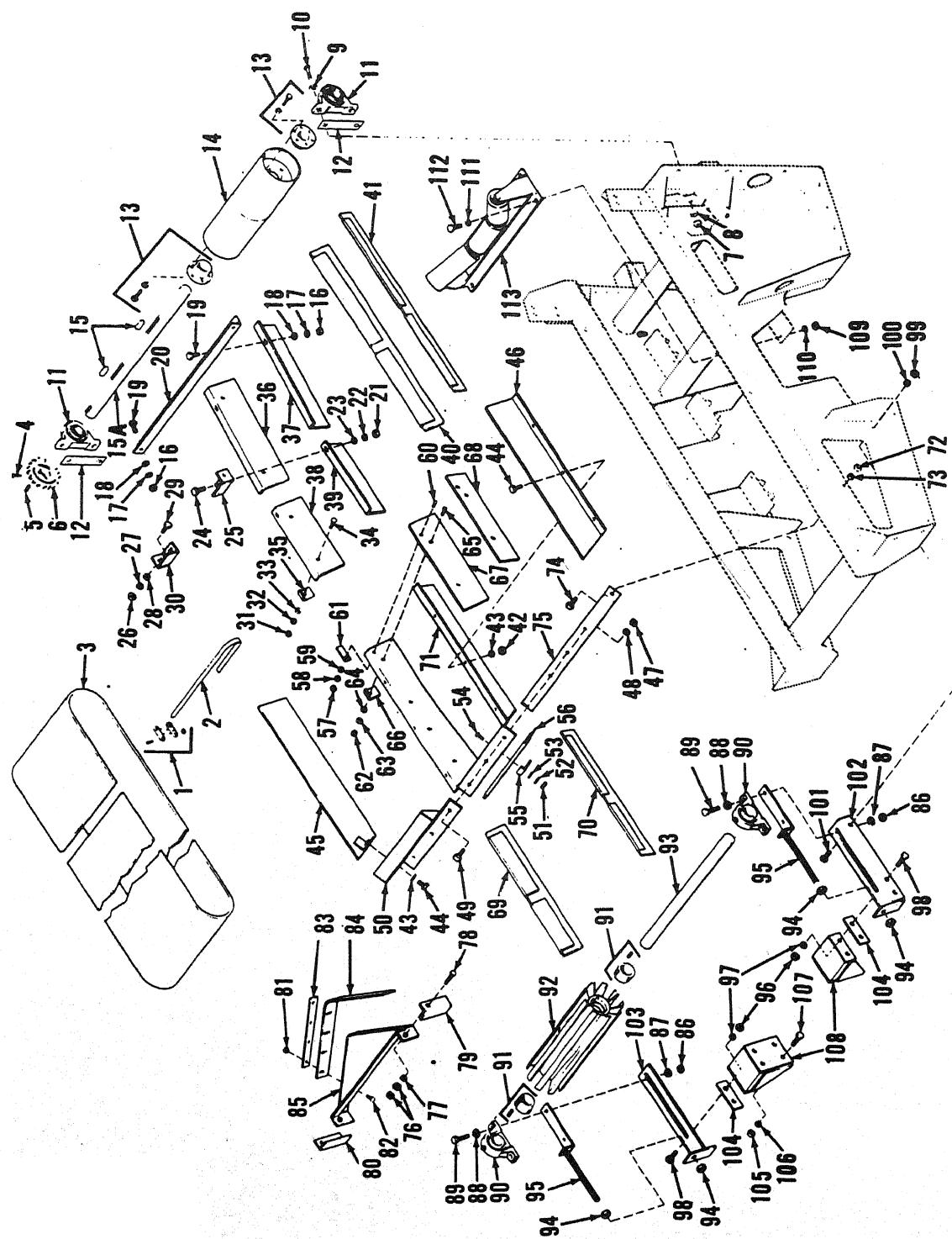


Figure 42-18. Spur gear guard assembly.

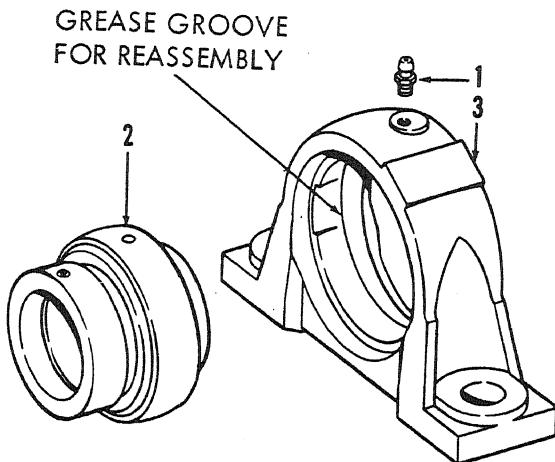


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Figure 43-1. Undercrusher conveyor exploded view.

1	Plate	38	Skirtboard (LH)	76	Nut
2	Tape	39	Skirtboard (RH)	77	Lockwasher
3	Belt	40	Flashing (LH)	78	Capscrew
4	Setscrew	41	Flashing (RH)	79	Support (LH)
5	Key	42	Nut	80	Support (RH)
6	Sprocket	43	Lockwasher	81	Nut
7	Nut	44	Capscrew	82	Bolt
8	Lockwasher	45	Hopper extension (LH)	83	Clamp
9	Washer	46	Hopper extension (RH)	84	Flashing
10	Capscrew	47	Nut	85	Frame
11	Bearing assembly	48	Lockwasher	86	Nut
12	Shim	49	Capscrew	87	Lockwasher
13	Bushing	50	Hopper extension (rear)	88	Washer
14	Pulley	51	Nut	89	Capscrew
15	Key	52	Lockwasher	90	Bearing assembly
16A	Shaft	53	Washer	91	Bushing
16	Nut	54	Bolt	92	Pulley
17	Lockwasher	55	Clamp	93	Shaft
18	Washer	56	Flashing	94	Nut
19	Capscrew	57	Nut	95	Bearing slide
20	Support	58	Lockwasher	96	Nut
21	Nut	59	Washer	97	Lockwasher
22	Lockwasher	60	Bolt	98	Capscrew
23	Washer	61	Connecting strap	99	Nut
24	Capscrew	62	Nut	100	Lockwasher
25	Support	63	Lockwasher	101	Capscrew
26	Nut	64	Washer	102	Bearing support (RH)
27	Lockwasher	65	Bolt	103	Bearing support (LH)
28	Washer	66	Clamp	104	Slim
29	Capscrew	67	Hopper liner (LH)	105	Nut
30	Support	68	Hopper liner (RH)	106	Lockwasher
31	Nut	69	Flashing (LH)	107	Capscrew
32	Lockwasher	70	Flashing (RH)	108	Bracket
33	Washer	71	Hopper	109	Nut
34	Bolt	72	Nut	110	Lockwasher
35	Clamp	73	Lockwasher	111	Washer
36	Skirtboard (LH)	74	Capscrew	112	Capscrew
37	Skirtboard (RH)	75	Support	113	Trough roll assembly

Figure 43-1—Continued.



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- 1 Fitting
- 2 Bearing
- 3 Housing

Figure 43-2. Head and tail pulley bearing exploded view.

Section X. UNDERCRUSHER CONVEYOR AND ELEVATING WHEEL DRIVE

75. General

The undercrusher conveyor and elevating wheel drive consists of four major components; a speed reducer, gear box, countershaft, and universal joint. The pulley located on the input shaft of the speed reducer is belt driven from the flywheel. The countershaft is connected to the output shaft of the speed reducer and input or drive shaft of the right angle gear box. The universal joint is connected to the output or driven shaft of the gear box and the elevating wheel drive shaft.

The head pulley of the undercrusher conveyor is chain driven from a sprocket mounted on the countershaft.

76. Undercrusher Conveyor and Elevating Wheel Drive

a. *Removal and Disassembly.* Remove and disassemble the undercrusher conveyor and

(6) Inspect hopper extensions and liners for wear and damage. Repair or replace defective parts as necessary.

(7) Inspect all parts for damage, and replace defective parts.

e. *Trough Roll Reassembly.* Reassemble the trough roll assembly in the reverse of the numerical sequence as illustrated on figure 33-2.

f. *Head and Tail Pulley Bearing Reassembly.* Refer to figure 43-2 and reassemble the pulley bearing assembly. Refer to the Operator's Manual for bearing grease requirements.

g. *Reassembly and Installation.*

(1) Reassemble and install the undercrusher in the reverse of the numerical sequence as illustrated on figure 43-1.

(2) Install the conveyor belt (Operator's Manual).

elevating wheel drive in the numerical sequence as illustrated on figure 44-1.

b. *Speed Reducer Disassembly.*

(1) Drain lubricant from speed reducer.

(2) Disassemble the speed reducer in the numerical sequence as illustrated on figure 44-2.

c. *Countershaft Bearing Disassembly.* Disassemble the countershaft bearing assembly as illustrated on figure 43-2.

d. *Gear Box Disassembly.*

(1) Drain lubricant from gear box.

(2) Disassemble the gear box in the numerical sequence as illustrated on figure 44-3.

e. *Cleaning, Inspection, and Repair.*

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Perform a magnetic inspection of the gears and shafts. Inspect gear teeth for wear, pitting, chipping, nicks, cracks, or scoring. Replace defective parts.

(3) Inspect shafts for wear and spring, or bent condition. Replace a defective shaft.

(4) Inspect bearings for wear, chipping, or nicks. Replace a defective bearing.

(5) Inspect all parts for excessive wear or damage. Replace or repair defective parts.

f. Gear Box Reassembly.

(1) Reassemble gear box assembly in the reverse of the numerical sequence as illustrated on figure 44-3. Insert or remove shims (39, 40, or 41 or 10, 11, 12 or 13) until a slight clearance of .006 to .008 inch is obtained between gears. Clearance can be checked with a feeler gauge through inspection plug hole (6). Also shims must be installed to obtain a flush position of both gears when examined through inspection hole. Make sure grease seals are positioned with knife edge of seal as shown on figure 44-3.

(2) Fill gear box with lubricant (Operator's Manual).

g. Countershaft Bearing Reassembly. Reassemble countershaft bearing assembly as illustrated on figure 43-2.

h. Speed Reducer Reassembly.

(1) Reassemble speed reducer in the reverse of the numerical sequence as illustrated

on figure 44-2. Follow the instructions below when installing gear and bearings.

(a) Heat gear (37) in oil (325°F—350°F) to shrink onto hub (40).

(b) Heat bearings (36) in oil (270°F—290°F) to shrink onto hub (40).

Caution: Any injury to the hub surfaces where the oil seals (34 and 46) rub will cause leakage, and a new hub will have to be installed.

Note. When pressing bearings (41 and 42) on shaft (45), press against the inner race, not the outer race, of the bearings.

(2) Fill cavity between the oil seals and housing bores with chassis grease to prevent oil leakage.

(3) Fill speed reducer with lubricant (Operator's Manual).

i. Reassembly and Installation. Reassemble and install the undercrusher conveyor and elevating wheel drive in the reverse of the numerical sequence as illustrated on figure 44-1.

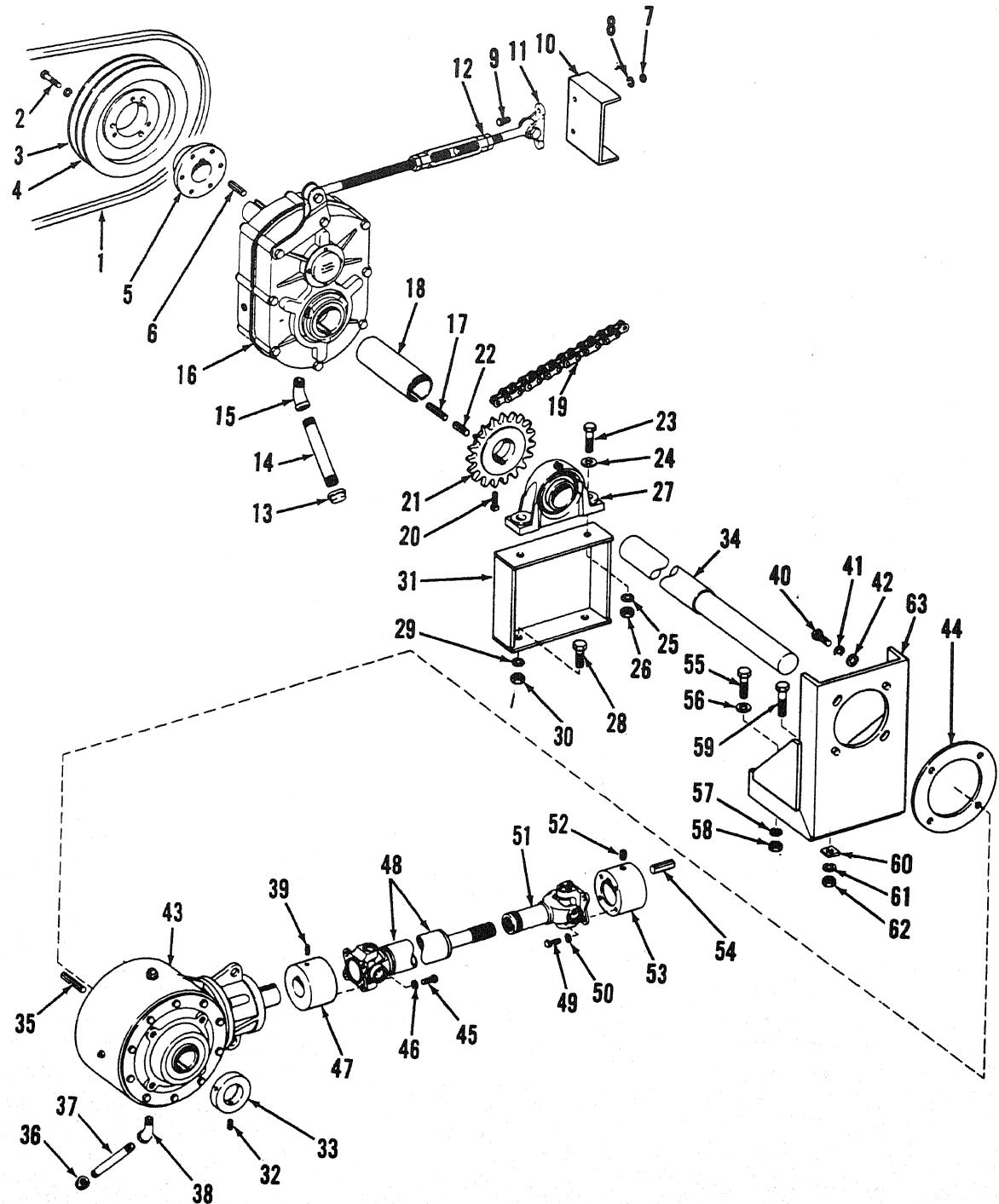
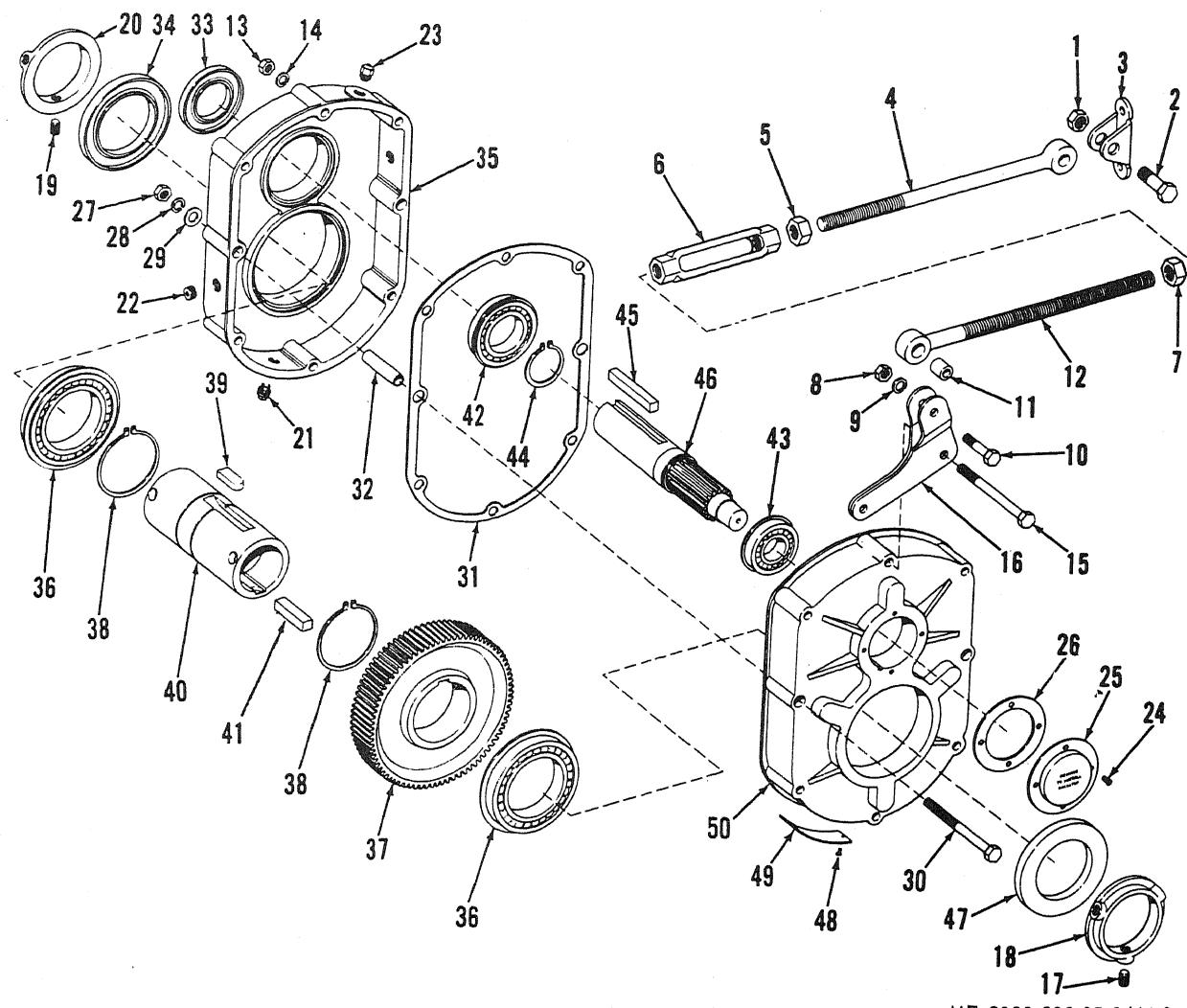


Figure 44-1. Undercrusher conveyor and elevating wheel drive, exploded view.

1	V-Belt	22	Key	43	Gear box
2	Capscrew	23	Capscrew	44	Shaft plate
3	Lockwasher	24	Washer	45	Capscrew
4	Pulley	25	Lockwasher	46	Lockwasher
5	Bushing	26	Nut	47	Coupling
6	Key	27	Bearing assembly	48	Universal joint
7	Nut	28	Capscrew	49	Capscrew
8	Lockwasher	29	Lockwasher	50	Lockwasher
9	Capscrew	30	Nut	51	Universal joint
10	Support	31	Support	52	Setscrew
11	Fulcrum	32	Setscrew	53	Coupling
12	Turnbuckle	33	Collar	54	Key
13	Cap	34	Shaft	55	Capscrew
14	Nipple	35	Key	56	Washer
15	Elbow	36	Cap	57	Lockwasher
16	Speed reducer	37	Nipple	58	Nut
17	Key	38	Elbow	59	Capscrew
18	Bushing	39	Setscrew	60	Washer
19	Chain	40	Capscrew	61	Lockwasher
20	Setscrew	41	Lockwasher	62	Nut
21	Sprocket	42	Washer	63	Support

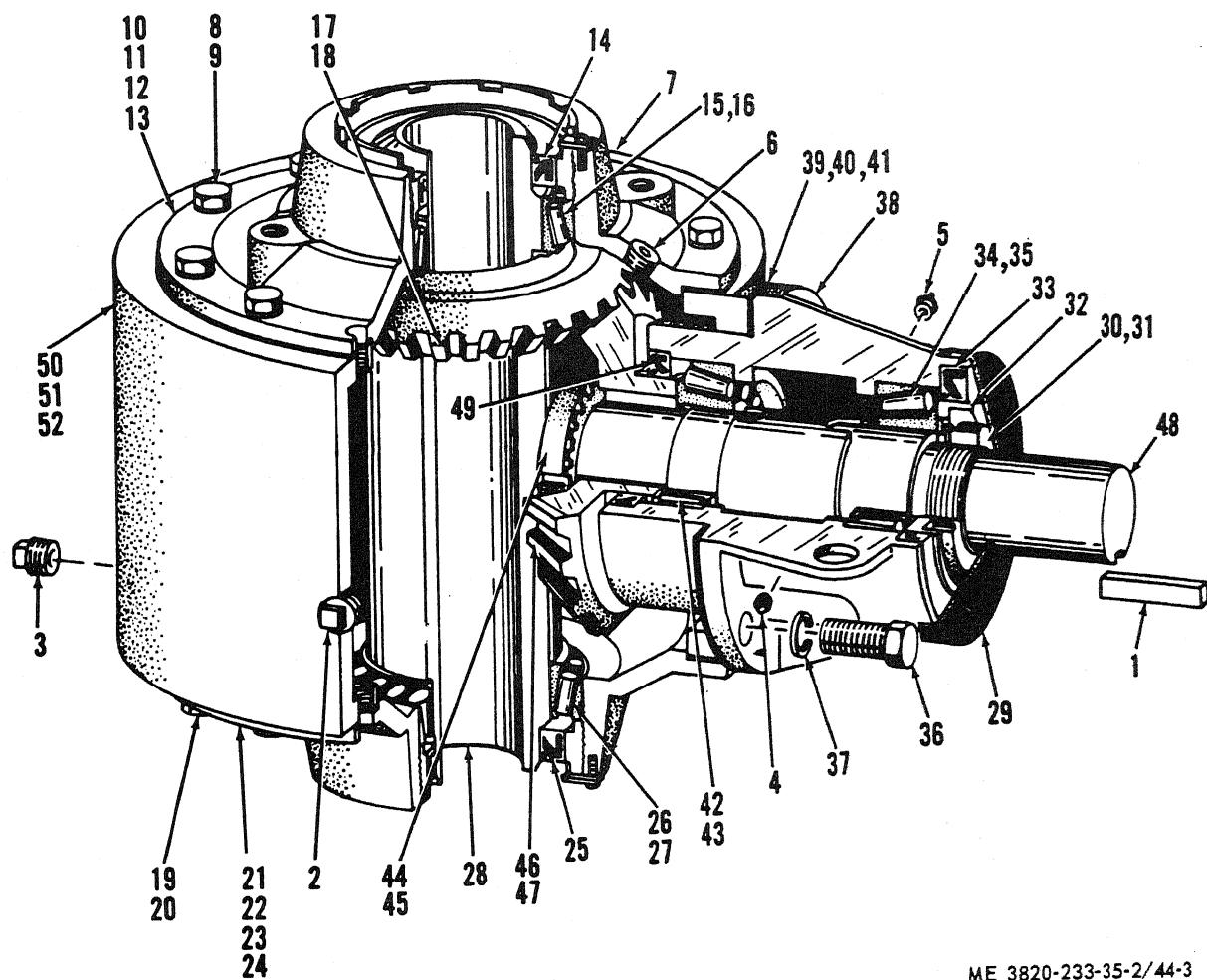
Figure 44-1—Continued.



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1	Nut	18	Collar	35	Housing
2	Bolt	19	Setscrew	36	Bearing
3	Fulcrum	20	Collar	37	Gear
4	Extension rod	21	Plug	38	Snap ring
5	Nut	22	Plug	39	Key
6	Turnbuckle	23	Plug	40	Hub
7	Nut	24	Screw	41	Key
8	Nut	25	Cover	42	Bearing
9	Lockwasher	26	Gasket	43	Bearing
10	Capscrew	27	Nut	44	Snap ring
11	Bushing	28	Lockwasher	45	Key
12	Rod	29	Washer	46	Shaft
13	Nut	30	Bolt	47	Seal
14	Lockwasher	31	Gasket	48	Screw
15	Bolt	32	Dowel pin	49	Identification plate
16	Adapter	33	Seal	50	Housing
17	Setscrew	34	Seal		

Figure 44-2. Speed reducer, exploded view.



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1 Key	19 Capscrew	37 Lockwasher
2 Plug	20 Lockwasher	38 Support
3 Plug	21 Cover	39 Shim
4 Plug	22 Shim	40 Shim
5 Fitting	23 Shim	41 Shim
6 Plug	24 Shim	42 Bearing cup
7 Plug	25 Seal	43 Bearing cone
8 Capscrew	26 Bearing cup	44 Lock nut
9 Lockwasher	27 Bearing cone	45 Lockwasher
10 Cover	28 Shaft	46 Key
11 Shim	29 Cover	47 Gear set, matched
12 Shim	30 Locknut	48 Shaft
13 Shim	31 Lockwasher	49 Seal
14 Seal	32 Seal retainer	50 Screw
15 Bearing cup	33 Seal	51 Identification plate
16 Bearing cone	34 Bearing cup	52 Housing
17 Key	35 Bearing cone	
18 Gearset, matched	36 Capscrew	

Figure 44-3. Gear box assembly, disassembly and reassembly.

Section XI. MAIN COUNTERSHAFT

77. General

The main countershaft assembly is located in front of the overhead conveyor head frame and is secured by two bearing assemblies which are bolted to the frame. The right and left hand countershaft bearing assemblies are similar in construction and maintenance procedures. The main countershaft is the means for transmitting power from the power unit to the plant drive assemblies.

78. Main Countershaft Assembly

a. Removal. Refer to figure 8 and remove the main countershaft.

b. Disassembly. Disassemble the main countershaft assembly in the numerical sequence as illustrated on figure 45-1.

c. Main Countershaft Bearing Disassembly. Disassemble the bearing assemblies as illustrated on figure 45-2.

d. Cleaning, Inspection, and Repair

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Perform a magnetic inspection of the countershaft. Inspect countershaft for wear or bent condition. Replace defective countershaft.

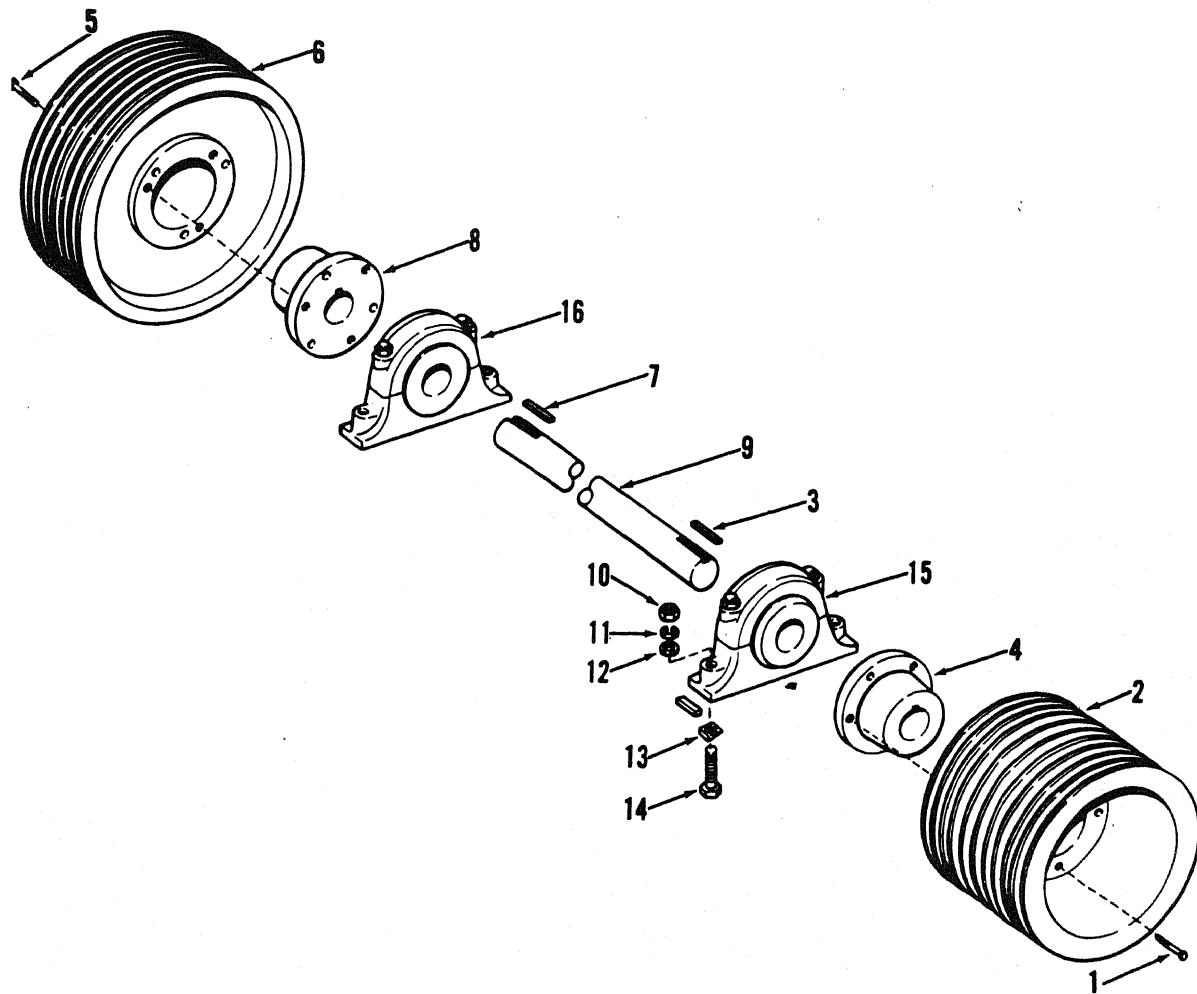
(3) Inspect bearings for wear, chipping, or nicks. Replace a defective bearing.

(4) Inspect all parts for excessive wear or damage. Replace or repair defective parts.

e. Main Countershaft Bearing Reassembly. Reassemble the bearing assemblies as illustrated on figure 45-2.

f. Reassembly. Reassemble the main countershaft assembly in the reverse of the numerical sequence as illustrated on figure 45-1.

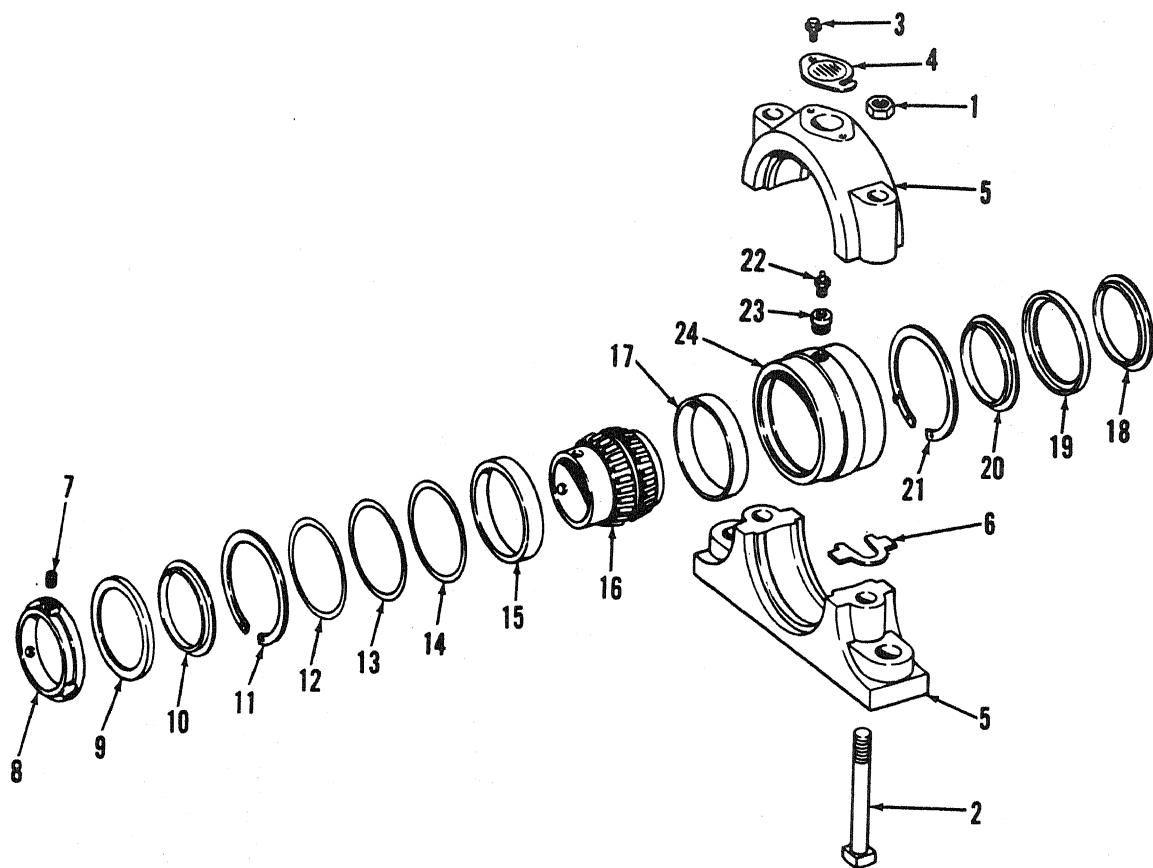
g. Installation. Refer to figure 8 and install the main countershaft.



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1 Cap screw	7 Key	13 Bevel washer
2 Sheave	8 Bushing	14 Cap screw
3 Key	9 Countershaft	15 Bearing assembly
4 Bushing	10 Nut	16 Bearing assembly
5 Cap screw	11 Lockwasher	
6 Sheave	12 Washer	

Figure 45-1. Main countershaft assembly, exploded view.



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1 Nut	9 Seal	17 Bearing cup
2 Bolt	10 Seal	18 Seal
3 Screw	11 Snap ring	19 Seal
4 Nameplate	12 Shim	20 Seal
5 Housing	13 Shim	21 Snap ring
6 Shim	14 Shim	22 Fitting
7 Setscrew	15 Bearing cup	23 Stud
8 Collar	16 Cone	24 Inner housing

Figure 45-2. Main countershaft bearing assembly, exploded view.

APPENDIX A

REFERENCES

1. Fire Protection

TB 5-4200-
200-10 Hand Portable Fire Extinguishers for Army Users.

2. Lubrication

C9100IL Fuels, Lubricants, Oil and Waxes
LO 5-3820-
233-12/2 Crusher, Jaw, Diesel Engine Driven, Semitrailer Mounted, 35 Ton per
Hour Capacity (Iowa Manufacturing Company Model 2A-2B).

3. Maintenance

TB ORD 651 Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling
Systems.
TM 5-3820-
233-12/2 Operator and Organizational Maintenance Manual.
TM 5-3820-
233-35P Direct and General Support and Depot Maintenance Repair Parts and
Special Tool List.
TM 5-764 Electric Motor and Generator Repair.
TM 9-1870-1 Care and Maintenance of Pneumatic Tires.
TM 38-750 Army Equipment Record Procedures.

4. Painting

TM 9-213 Painting Instructions for Field Use.

TM 5-3820-233-35/2

By Order of the Secretary of the Army:

Official:

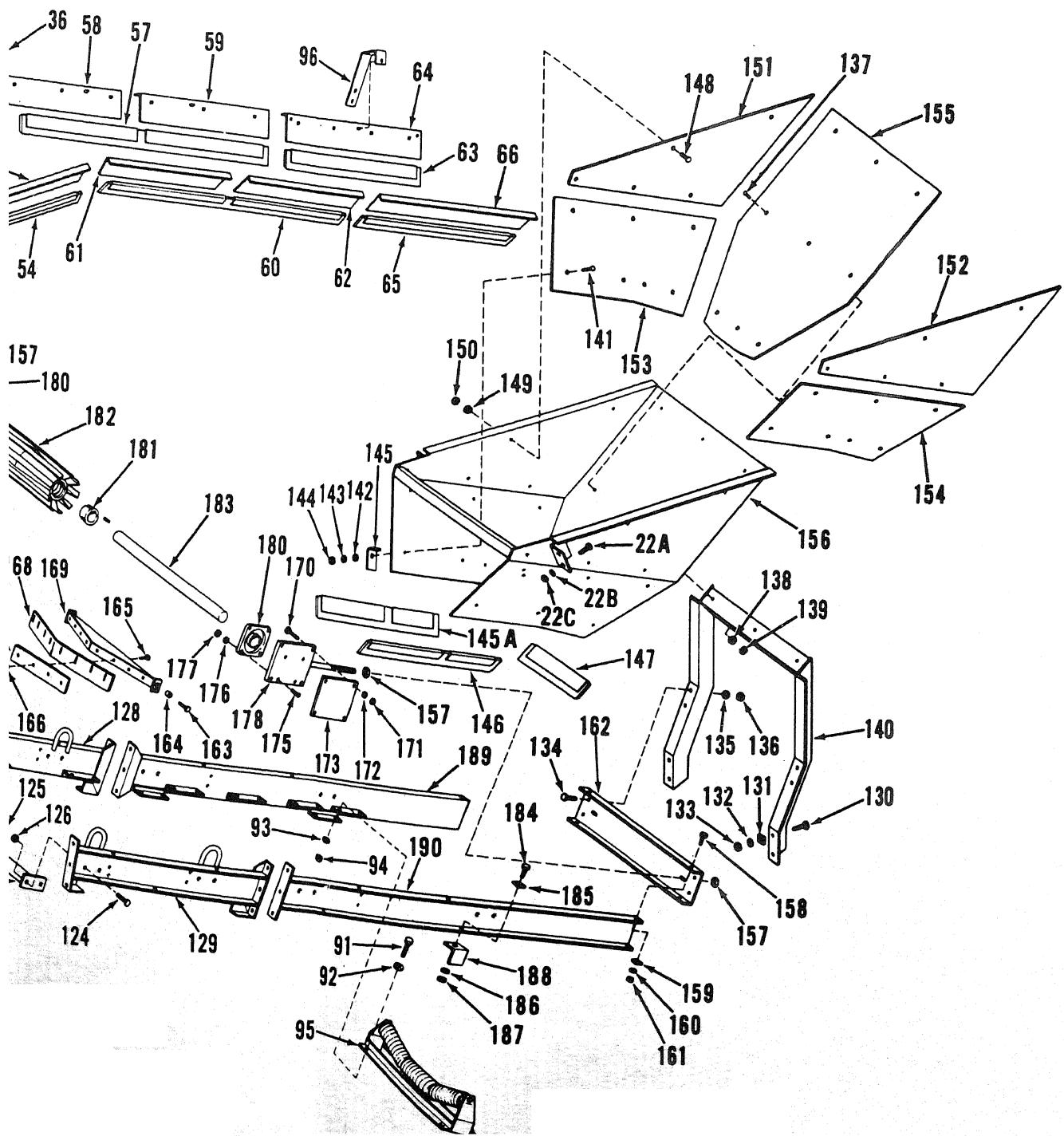
HAROLD K. JOHNSON
*General, United States Army,
Chief of Staff.*

KENNETH G. WICKHAM,
*Major General, United States Army,
The Adjutant General.*

Distribution:

To be distributed in accordance with DA Form 12-25, Sec II (qty rqr Block #451) requirements for Direct and General Support maintenance, Rock Drilling equipment.

62	Skirtboard	127	Spreader
63	Flashing	128	Frame
64	Skirtboard	129	Frame
65	Flashing	130	Capscrew
66	Skirtboard	131	Bevel washer
67	Capscrew	132	Lockwasher
68	Bevel washer	133	Nut
69	Lockwasher	134	Capscrew
70	Nut	135	Lockwasher
71	Bolt	136	Nut
72	Lockwasher	137	Bolt
73	Nut	138	Lockwasher
74	Liner	139	Nut
75	Baffle	140	Support
76	Capscrew	141	Bolt
77	Lockwasher	142	Washer
78	Nut	143	Lockwasher
79	Bearing assy	144	Nut
80	Bearing assy	145	Clamp
81	Capscrew	145A	Flashing
82	Lockwasher	146	Flashing
83	Bushing	147	Flashing
84	Pulley	148	Bolt
85	Key	149	Lockwasher
86	Shaft	150	Nut
87	Capscrew	151	Liner
88	Washer	152	Liner
89	Nut	153	Liner
90	Support	154	Liner
91	Capscrew	155	Liner
92	Washer	156	Hopper
93	Lockwasher	157	Nut
94	Nut	158	Capscrew
95	Impact roll assy	159	Bevel washer
96	Support	160	Lockwasher
97	Capscrew	161	Nut
98	Washer	162	Tie end
99	Lockwasher	163	Capscrew
100	Nut	164	Pipe
101	Trough roll assy	165	Bolt
102	Capscrew	166	Nut
103	Washer	167	Clamp
104	Lockwasher	168	Flashing
105	Nut	169	Frame
106	Scraper	170	Capscrew
107	Return roll assy	171	Lockwasher
108	Capscrew	172	Nut
109	Bevel washer	173	Plate
110	Lockwasher	174	Plate
111	Nut	175	Capscrew
112	Support	176	Lockwasher
113	Capscrew	177	Nut
114	Bevel washer	178	Plate
115	Lockwasher	179	Plate
116	Nut	180	Bearing assy
117	Support	181	Bushing
118	Capscrew	182	Pulley
119	Lockwasher	183	Shaft
120	Nut	184	Capscrew
121	Spreader	185	Bevel washer
122	Frame	186	Lockwasher
123	Frame	187	Nut
124	Capscrew	188	Clip
125	Lockwasher	189	Frame
126	Nut	190	Frame



-1. Overhead conveyor, exploded view.

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* U. S. GOVERNMENT PRINTING OFFICE: 1989 -242-451/ 5624

1	Belt plate	62	Skirtboard	127	Spreader
2	Belt tape	63	Flashing	128	Frame
3	Belt	64	Skirtboard	129	Frame
4	Capscrew	65	Flashing	130	Capscrew
5	Lockwasher	66	Skirtboard	131	Bevel washer
6	Nut	67	Capscrew	132	Lockwasher
7	Shim	68	Bevel washer	133	Nut
8	Tie	69	Lockwasher	134	Capscrew
9	Capscrew	70	Nut	135	Lockwasher
10	Lockwasher	71	Bolt	136	Nut
11	Nut	72	Lockwasher	137	Bolt
12	Support	73	Nut	138	Lockwasher
13	Support	74	Liner	139	Nut
14	Support	75	Baffle	140	Support
15	Support	76	Capscrew	141	Bolt
16	Capscrew	77	Lockwasher	142	Washer
17	Lockwasher	78	Nut	143	Lockwasher
18	Nut	79	Bearing assy	144	Nut
19	Support	80	Bearing assy	145	Clamp
20	Capscrew	81	Capscrew	145A	Flashing
21	Lockwasher	82	Lockwasher	146	Flashing
22	Nut	83	Bushing	147	Flashing
22A	Capscrew	84	Pulley	148	Bolt
22B	Lockwasher	85	Key	149	Lockwasher
22C	Nut	86	Shaft	150	Nut
23	Capscrew	87	Capscrew	151	Liner
24	Lockwasher	88	Washer	152	Liner
25	Nut	89	Nut	153	Liner
26	Support	90	Support	154	Liner
27	Support	91	Capscrew	155	Liner
28	Capscrew	92	Washer	156	Hopper
28A	Washer	93	Lockwasher	157	Nut
29	Lockwasher	94	Nut	158	Capscrew
30	Nut	95	Impact roll assy	159	Bevel washer
31	Capscrew	96	Support	160	Lockwasher
32	Washer	97	Capscrew	161	Nut
33	Lockwasher	98	Washer	162	Tie end
34	Nut	99	Lockwasher	163	Capscrew
35	Support	100	Nut	164	Pipe
36	Capscrew	101	Trough roll assy	165	Bolt
37	Lockwasher	102	Capscrew	166	Nut
38	Nut	103	Washer	167	Clamp
39	Connecting strap	104	Lockwasher	168	Flashing
40	Bolt	105	Nut	169	Frame
41	Washer	106	Scraper	170	Capscrew
42	Lockwasher	107	Return roll assy	171	Lockwasher
43	Nut	108	Capscrew	172	Nut
44	Clamp	109	Bevel washer	173	Plate
45	Flashing	110	Lockwasher	174	Plate
46	Skirtboard	111	Nut	175	Capscrew
47	Skirtboard	112	Support	176	Lockwasher
48	Flashing	113	Capscrew	177	Nut
49	Skirtboard	114	Bevel washer	178	Plate
50	Skirtboard	115	Lockwasher	179	Plate
51	Flashing	116	Nut	180	Bearing assy
52	Skirtboard	117	Support	181	Bushing
53	Skirtboard	118	Capscrew	182	Pulley
54	Flashing	119	Lockwasher	183	Shaft
55	Skirtboard	120	Nut	184	Capscrew
56	Skirtboard	121	Spreader	185	Bevel washer
57	Skirtboard	122	Frame	186	Lockwasher
58	Flashing	123	Frame	187	Nut
59	Skirtboard	124	Capscrew	188	Clip
60	Flashing	125	Lockwasher	189	Frame
61	Skirtboard	126	Nut	190	Frame